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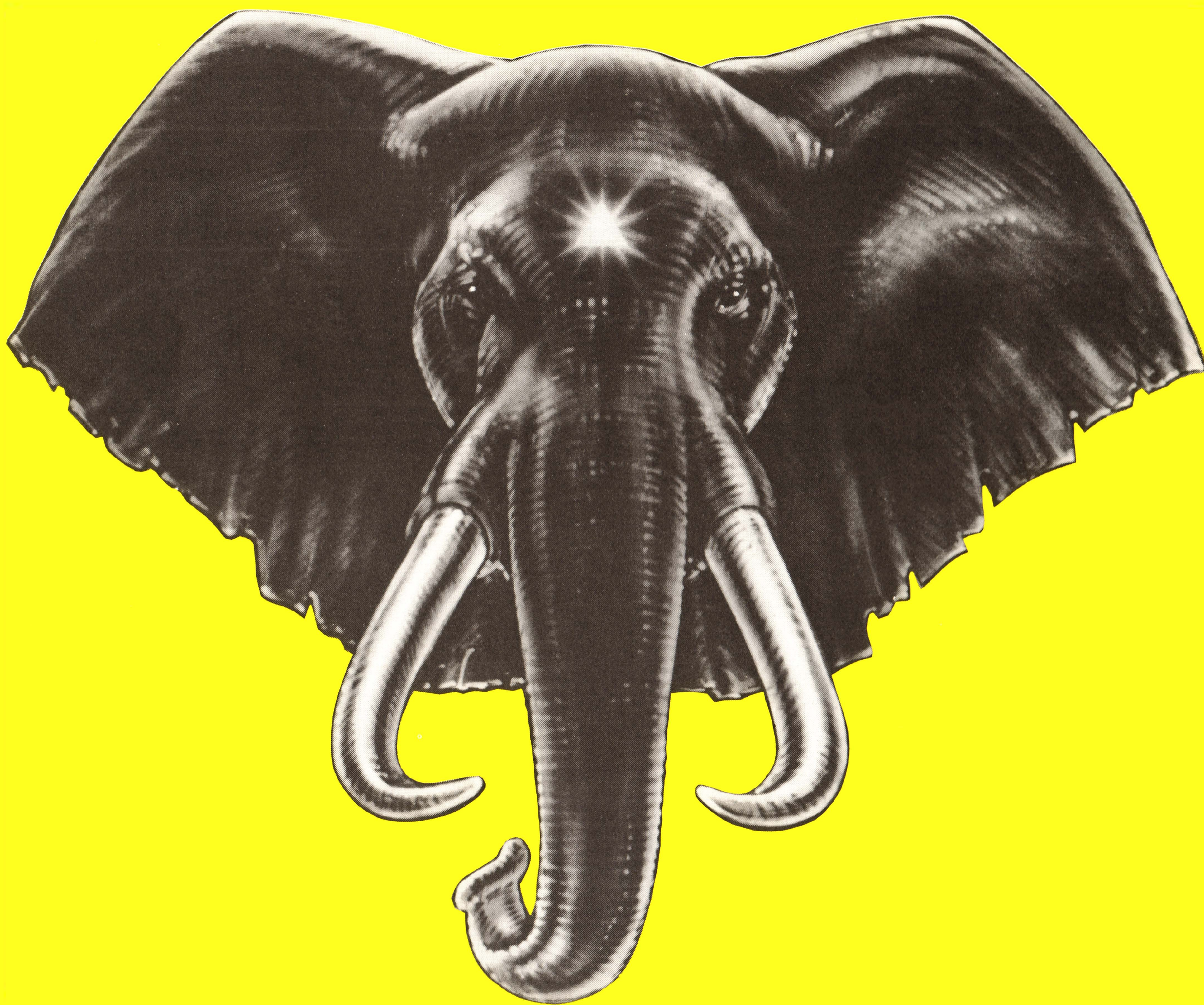
What Do You Do
After You Plug It In?



High (Tech) Anxiety
Pg. 46



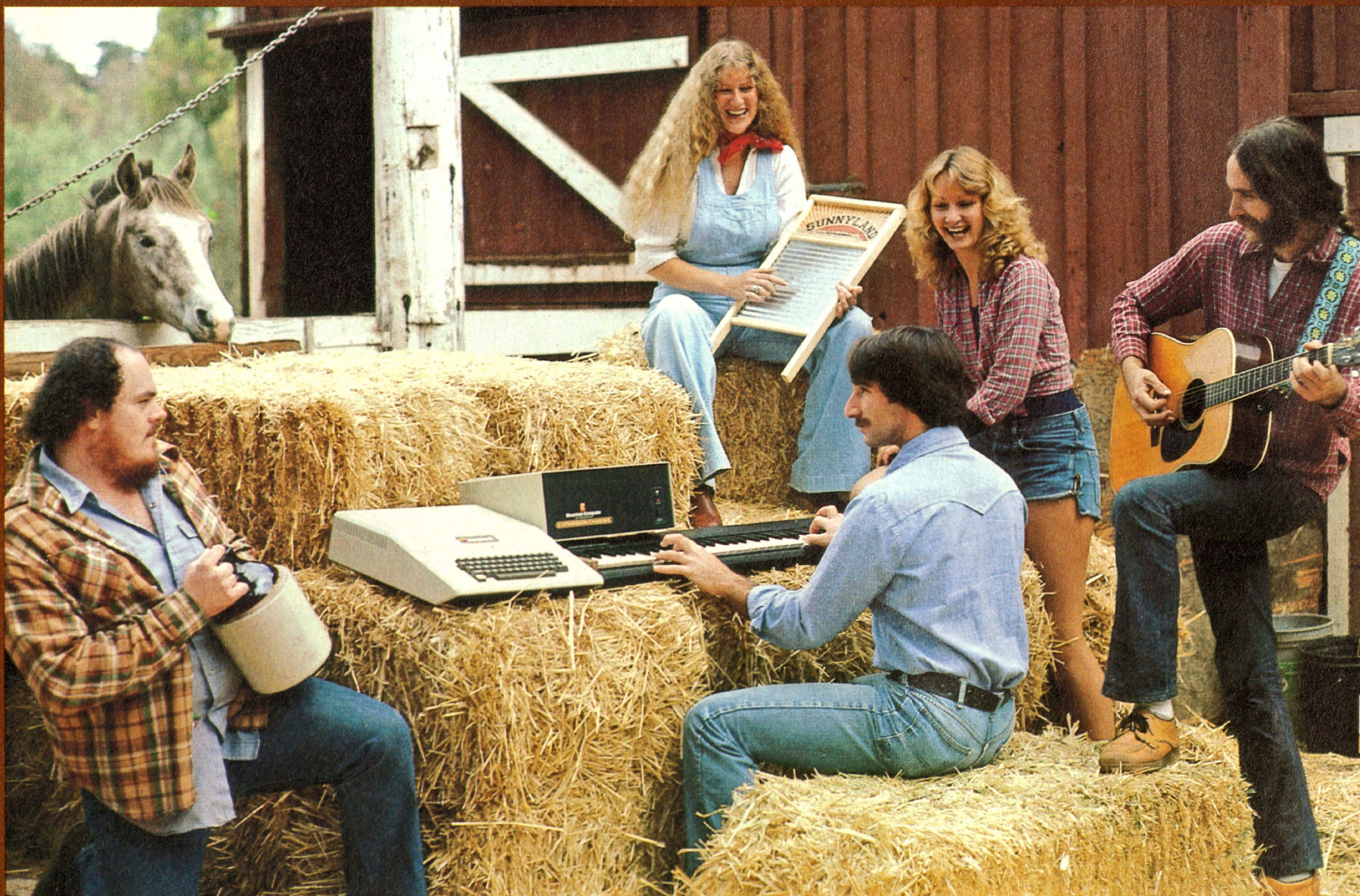
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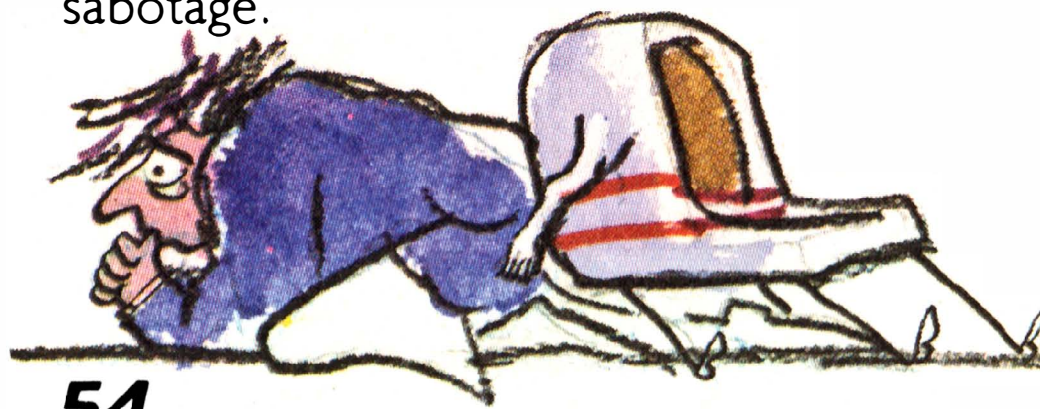
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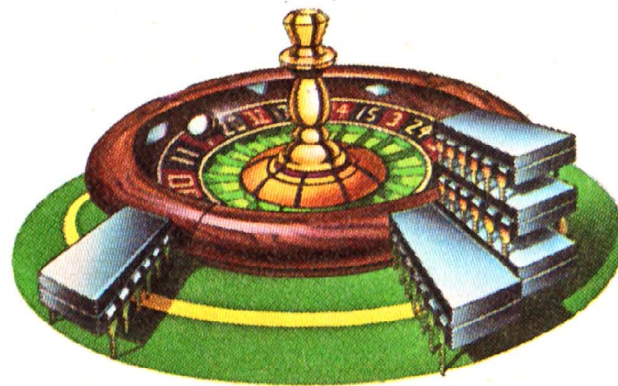
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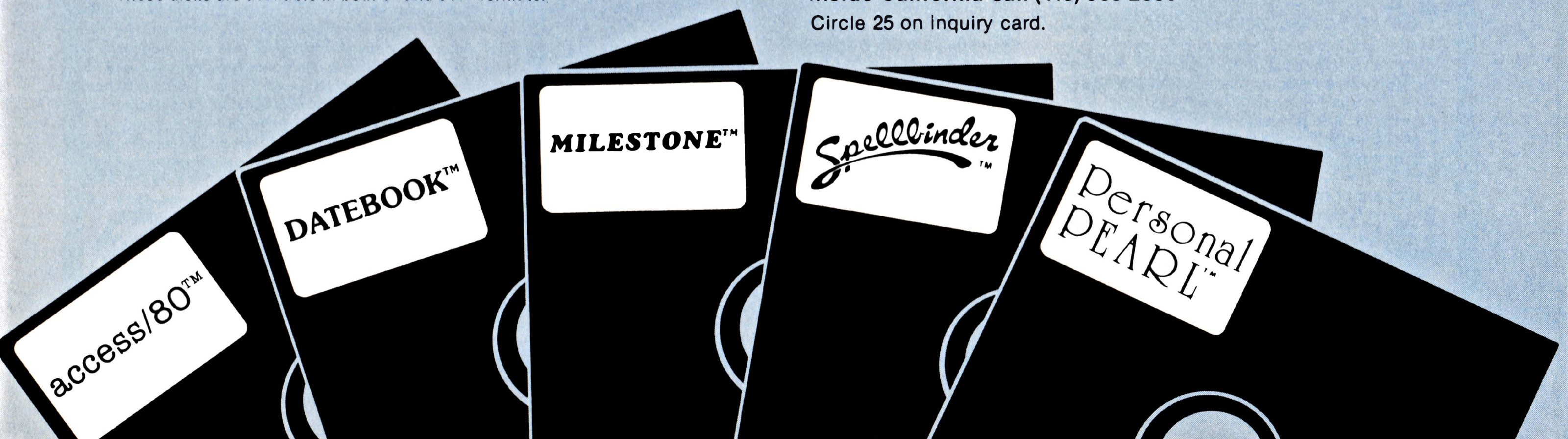
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Popular's Views

Traveling Hopefully

Are you just about to buy a computer?

There must be some spark of computer madness in you since you're reading this issue of *Popular Computing*. If there's a computer in your future, I have three words of advice: Buy it now.

Learning by doing was never so apropos as it is with computers. More than one million personal computers are in circulation today, the proud possessions of people who sometimes took risks—people who answered the call to master a new tool.

But today the risks are much smaller: prices are lower, reputable companies are at work in our field, software is friendlier and more dependable, and hardware is more reliable.

So what's stopping you? It could be the sort of paralysis that sets in when the enormity of choices hits home. Computer companies complicate matters by their irresistible habit of announcing new versions of old machines and almost monthly scrapping the status quo. But these tactics should not deter you from mastering the machines that are eventually going to change your life.

This month we present four portraits of the current media stars: those computers that have proven their worth in a highly competitive field. Some have features that others lack, their prices vary, but all have proven they can attain at least a minimum level of performance.

What computer you buy, of course, depends on what you need to do and what you can afford to spend. And don't worry that your machine will become obsolete—the skills you develop using a computer now can be used with future machines. **tants**

Over the past four years I've had the chance to audition just about every popular computer, and I've learned something valuable in every case. People often ask me which machine is the best; again, the answer depends on the individual. Of the four machines on the cover, I probably use the Apple II and the TRS-80 the most. But that's because of my particular needs. You might find that you're better off with the Commodore or Atari. In fact, my ideal machine would combine the best features of the four machines and eliminate the more irksome ones. But there will *always* be irksome features on any computer I could ever own—and delights, too. In a sense, the computerphile is on an extended educational odyssey.

The Chinese, as always, have a saying for it: "It is better to travel hopefully than to arrive."

I hope you buy your ticket soon. □

Chris Morgan
Editor in Chief

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Ask Popular

Ask Popular is a monthly column in which we answer general questions about small computers. Send your questions to: Ask Popular, POB 397, Hancock, NH 03449.

Q Every time I look at specifications for computers, I see the letter K in reference to the amount of memory. What does that mean?

A A lowercase "k" is the symbol for 1000, but in the computer world K stands for 1024 bytes of memory. (Remember that each byte stores one character.) The reason that a K is 1024 and not 1000 is because of the way information is stored in a computer. Amounts of memory must be in multiples of 8 bits (a byte), and 8 doesn't divide evenly into 1000.

So when a computer salesperson says that a computer has 16 K of internal storage, he actually means the computer has 16,384 bytes of internal memory storage. If he says it has 48 K, it means there are 49,152 bytes of storage.

Q In product descriptions for personal computers, I often come across the terms "parallel interface" and "serial interface." What do they mean?

A In any computer, an interface is a means of communication between two parts of the system (for example, the floppy disk and the microprocessor, the keyboard and the microprocessor, or the microprocessor and the printer). Parallel and serial refer to the way the communication takes place.

Serial means in a series, and that is exactly what a serial interface is—a pair of wires (a circuit) across which information is sent one bit at a time (serially). The most common type of serial interface is the RS-232C. The

designation represents the way in which the series is sent so that different computers can communicate with accessories (more commonly known as peripherals) made by different manufacturers.

A parallel interface has many more wires (normally 10 to 12) across which many bits of information are sent at once (in parallel). The peripheral receiving the information must have special circuitry to sort out the data. A parallel interface works much faster than a serial interface, which is the reason it's used *inside* a computer (where it's called a bus) for communication between the microprocessor, memory, and keyboard.

Q What's the difference between floppy-disk sizes? Also, what's meant by the term "double-density"?

A There are two common floppy-disk sizes, 5¼-inch "minis" and 8-inch standards. The smaller disks are used with lower-priced systems. Their typical storage capacity is around 80,000 bytes (about 45 double-spaced typewritten pages). Some of this storage is usually taken up by system or applications software. Many disk systems are now capable of double-density storage (160,000 characters or more on a single disk). Double-density storage requires a higher grade of disk media (manufacturers often use the term "double-density certified").

Eight-inch disks have storage capacities in the range of 500,000 characters (double-density).

A useful concept is "on-line storage." That's the amount of storage available to your computer without having to

swap disks in disk drives. For example, a mini-disk system with two double-density drives may have on-line storage of over 300,000 characters.

Q What's word processing and how does it work?

A Word processing refers to using a computer for manipulating and editing text—writing letters or reports, for example. (This column is written on a small computer using a word-processing program.) When a computer is used, text can be changed, added to, or moved around until the author is satisfied. Then, as many copies as are needed can be printed out.

Although there are many special (and expensive) computers designed to do word processing exclusively, any personal computer can be turned into a word processor with the right software. Of course, a printer is an absolute necessity.

Q Why do some programs work fast and some slow?

A Many factors are involved. Programs written in high-level languages such as BASIC will usually be slower than similar programs written in the computer's machine language. Computers handle the translation process in one of two ways: they either *interpret* the program by looking at one line at a time every time the program is run and translating it into binary code, or they *compile* the program into 1s and 0s all at once the first time the program is run. Although a compiled program is much faster, some languages don't lend themselves very well to this process.

Input and output operations are much slower than internal operations. For example, it may take one second to get a record from a disk, but only a thousandth of a second to get the same record if it is already in the computer's memory.

Continued on page 10

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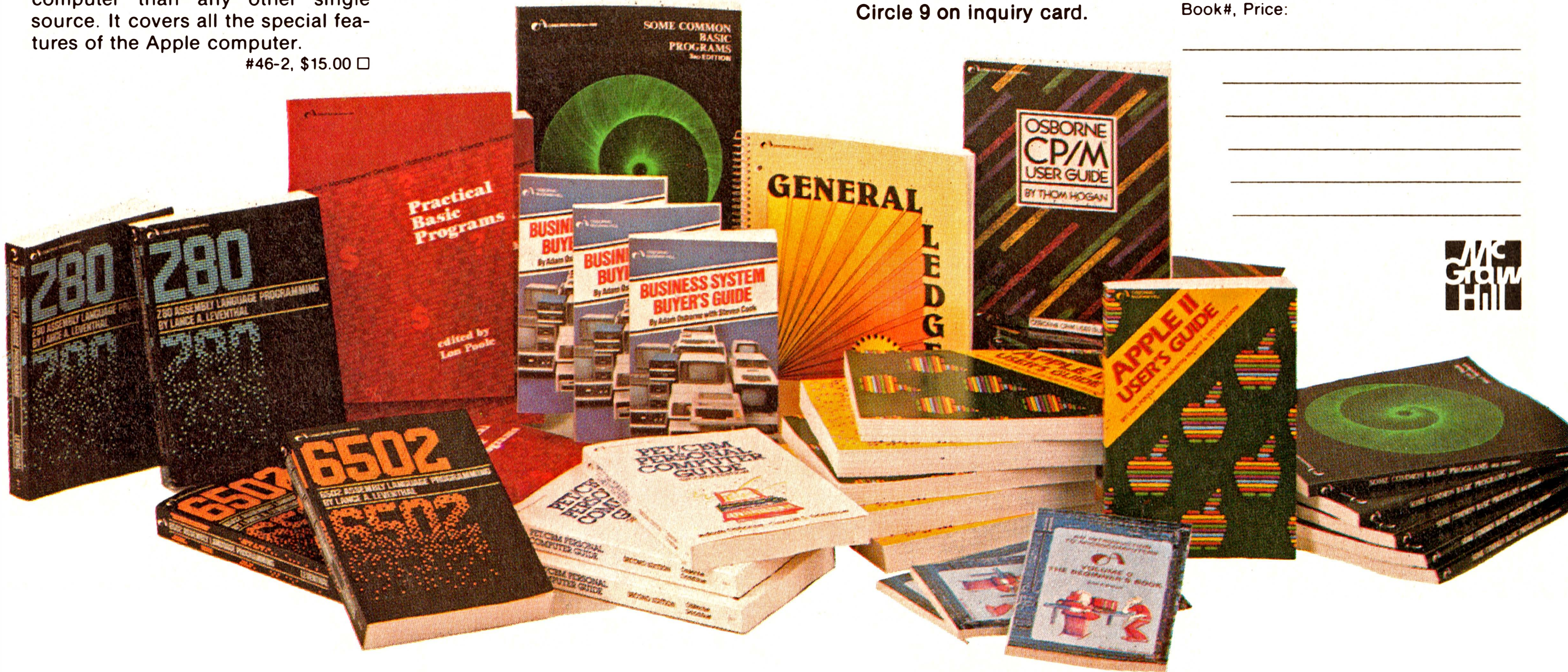
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Baked Apple.

Last Thanksgiving, a designer from Lynn/Ohio Corporation took one of the company's Apple Personal Computers home for the holidays.

While he was out eating turkey, it got baked.

His cat, perhaps miffed at being left alone, knocked over a lamp which started



a fire which, among other unpleasantries, melted his TV set all over his computer. He thought his goose was cooked.



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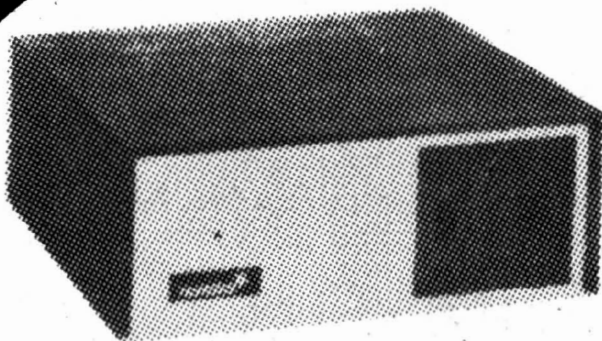
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Some types of computations are inherently slower than others. For example, the more precision required by an accounting program, the more time the program will take for arithmetic operations.

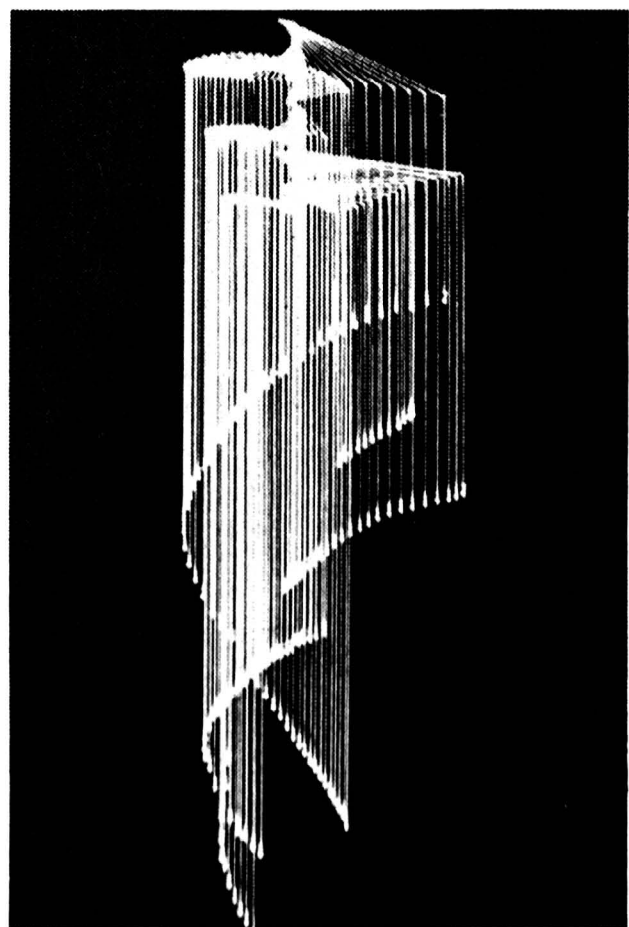
To put this issue into perspective: for the majority of personal and small-business applications, the speed at which a program runs isn't as important as, say, the ease of using it or the amount of memory it requires.

Q I've heard a lot about "bubble memory." What is it and how does it work?

A So-named because it uses tiny magnetic domains shaped like bubbles, bubble memory is high-density (over 128,000 bytes in a match-book-size package) and nonvolatile (it doesn't lose data when power is removed). For these reasons, it was thought to be the ultimate memory for small computers of the future until recently. However, because of their present high cost, bubble memories are now viewed mainly as special-application devices. For example, they are used in telephone circuits to store data for voice-synthesized "operators." It will probably be several years before they become generally available.

The theory is fascinating. Inside a tiny package, electromagnetic coils cause magnetic "bubbles" to race around tracks in tight formation. The presence or absence of a bubble in a given position indicates a 1 or 0—the fundamental units of information in a digital computer. Bubble memories can deliver a steady 100,000 of these 1s and 0s per second to a waiting microprocessor. That's much higher than the effective information transfer rate of a floppy-disk drive.

Despite American industry's skepticism about the current usefulness of bubble memories in consumer products, at least one Japanese personal computer uses them in cartridge form—Fujitsu's Bubcom 80. □



Programmer, Artist Create Playboy Sculpture

Combining diverse skills, artist Rob Fisher and computer programmer Frederick R. Stocker have created a spectacular five-story steel, glass, and Plexiglas sculpture for Playboy's Atlantic City, New Jersey, casino and hotel.

Fisher, who holds an engineering degree from MIT, decided to use a computer when he was commissioned for the sculpture two years ago. He wanted it to resemble the curtains of the aurora borealis, a light phenomenon in northern skies. But the variables involved in constructing such a work of art were overwhelming. With Stocker's help, however, Fisher entered more than 5000 components and engineering specifications into a computer. Once this information was analyzed, the computer generated a graphics display (see picture) of the proposed sculpture. It took one year for Fisher to complete the work, which consists of thousands of pieces of hand-blown Plexiglas, polished brass, and other materials.



Computer Graphics Train Pilots for Combat Missions

The computer-simulated flight tests that teach military pilots to fly, refuel in mid-air, drop air-to-ground missiles, navigate, take off, and land are becoming more realistic. Experts say they can now vary weather and lighting conditions to mimic almost any real-life situation.

Link, a division of the Singer Company in Sunnyvale, California, offers computer simulations using 64 colors with moving targets, clouds, and other visual situations that might confront a pilot on maneuvers. Other companies offer realistic sounds such as the whine of a turbine engine and aerodynamic hisses.

Pilots do not take their tests on typical video-display ter-

minals. Images of the fictitious situation are projected on a larger screen, giving the appearance of depth and the feeling of being in a cockpit. One important aspect of computer-simulated tests is that they are cost-effective. The military stands to save thousands of dollars if future pilots drop a make-believe missile rather than a \$5000 real one.

Even though tests aren't real, pilots take them seriously. In fact, military brass say the pilots emerge from the test in a sweat, as if they've been "put through the wringer." The Federal Aviation Administration has already approved simulated test flights for pilot retraining.

Computerizing Companies Should Watch Employee Morale

Businesses are computerizing with long-awaited glee. After all, computers are heralded as growth hormones for the marketplace, swords that knife through red tape and payroll complications, and the ultimate service department manager. But firms that are cheerily plopping computer terminals on employees' desks should keep an eye on morale, according to MIT's Shoshanah Zuboff, in a study entitled "Psychological and Organizational Work."

While business computers may be intended to raise productivity on all levels, says Zuboff, the electronic wonder-kind may actually be increasing stress, creating job boredom, undermining loyalty to the firm, and lowering production. When workers feel that their skills and worth to the company are being undercut by a computer, they begin to feel "insignificant and overwhelmed . . . this situation can exacerbate the issues of power and powerlessness that haunt all levels of organizational life."

Zuboff contends that when employees believe that they have lost control over work environs, the result may be computer or system sabotage as well as sharp increases in sick leave and related problems. Also, employees may try to prove the system ineffective or simply not use it at all. Most managers, she adds, do not take such trends into account when computerizing their firm. Zuboff warns that greater at-

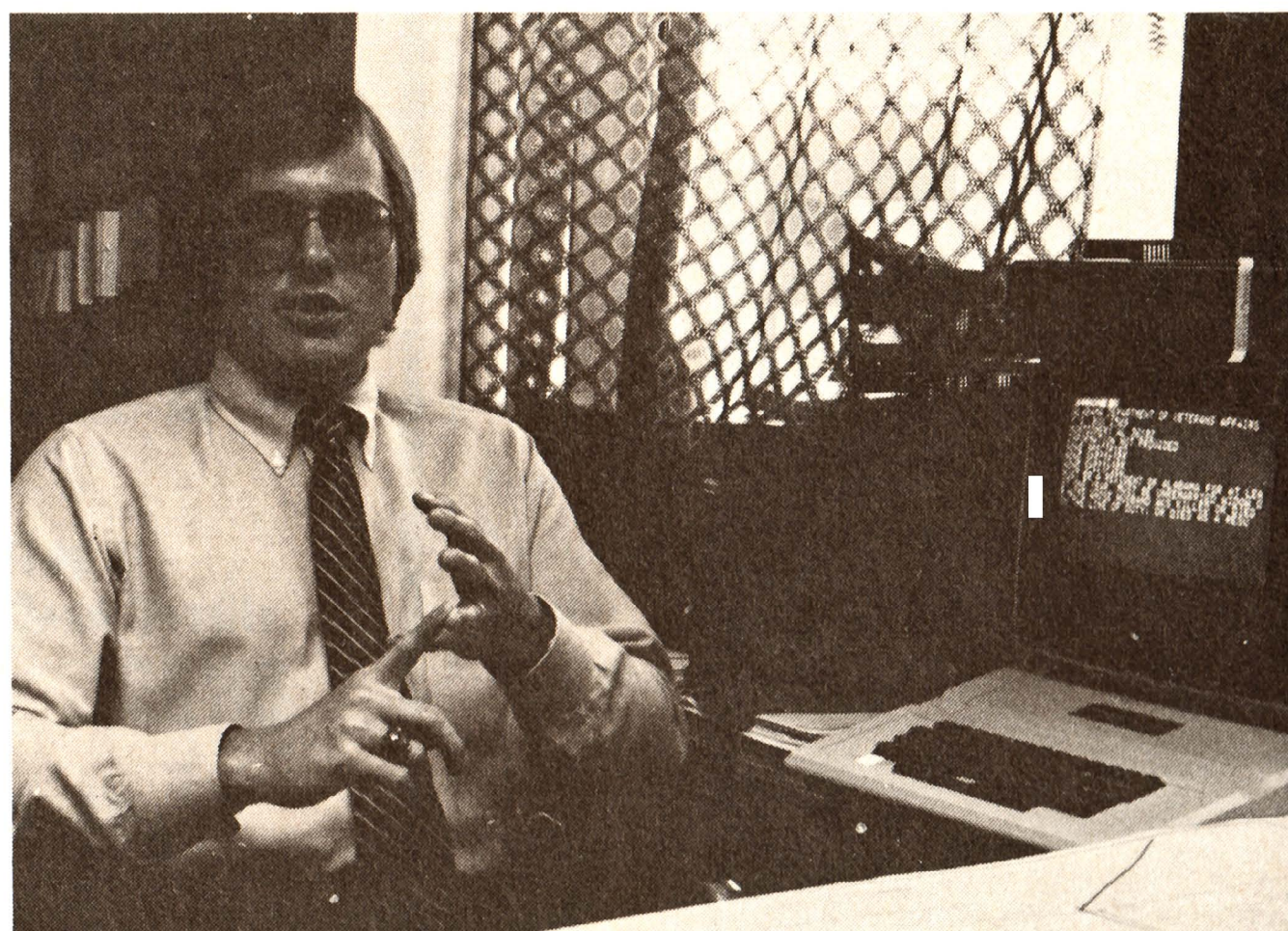
tention should be paid to the psychological impacts of the new technology on employees to avoid these problems.

Wilbert Galitz, a consultant for CNA Insurance, agrees. Speaking at a recent National Institute for Occupational Safety and Health conference, Galitz said computer systems flop because upper-level managers fail to deal with the issue of change.

Managers should plan for change, says Galitz. They

should determine the best time to carry out office automation and take slow steps so that employees can adjust.

Management goals for computerization should be made clear as well, Galitz says. System design is also critical, he added. The computer system should be easy to use, within current employee capabilities, and thorough documentation and training should be available.



Computerized Scholarship Service Helps Students Locate Funds

More than \$140 million worth of scholarships went unclaimed last year, mainly because no one knew the money was available. This year a new company, using a battery of personal computers, wants to make sure all that money finds its way to deserving students.

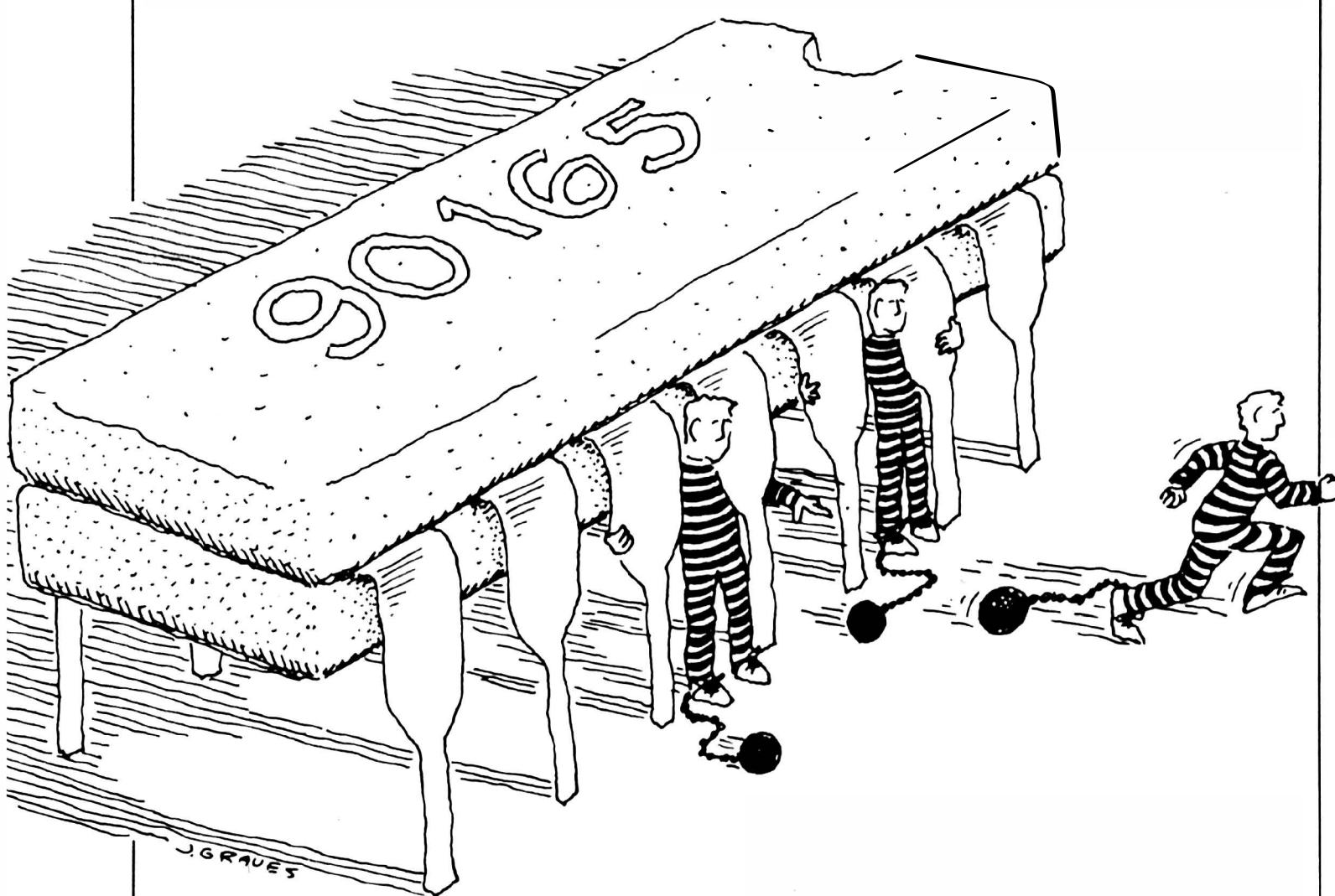
The National Scholarship Research Service (NSRS), headquartered in San Rafael, California, does not administer the grants itself. The service acts as a liaison between organizations with scholarship money and students seeking financial assistance.

It's all too easy to miss out on potential scholarships, says NSRS president Daniel Cassidy, even though some 250,000 private grants worth about \$1 billion are available. While most college financial-aid officers know about state, federal, and alumni grants, they rarely keep track of the multitude of private scholarships awarded by individuals, trusts, unions, and thousands of large and small organizations. For example, Cassidy notes that probably few people

know the Kosciuszko Foundation in New York gives deserving graduate students up to \$1000 to study Polish history, journalism, or "Polish Contributions to America." Or that if you intend to pursue a graduate degree in malacology—the study of mollusks—you may qualify for a \$500 scholarship offered by the National Capital Shell Club in Washington, D.C.

Perhaps even more interesting is the fact that 80% of the grants tracked by NSRS don't require a showing of financial need. The Eisenhower Memorial Scholarship Foundation, for instance, offers grants up to \$8000, regardless of the income of a student and his or her parents. But to qualify, the applicant must never have attended college and have "faith in a divine being and a firm belief in the free enterprise system and the American way of life."

NSRS has information on about a fifth of all private scholarships available and adds some 70 sources a week to its computer files. Cassidy fully intends to track information on every remaining private



Escapes Slashed in Half

By computerizing statistics on inmates, a behavioral psychologist in Atlanta has cut in half the escape rate in Georgia's state prison system.

Herbert Eber's program, called Visor, gives prison officials up-to-date information on each inmate's status and lets guards and wardens determine whether this matches prisoner characteristics. When Eber began collecting computerized data from different prisons, he found prisoner records bore little resemblance to what was actually happening behind bars. In some cases, Eber no-

ticed that inmates were being kept in maximum security for no apparent reason.

The major part of Eber's work consists of giving psychological tests to incoming prisoners. Prison officials then feed this information into a computer that prints out a narrative report with specific recommendations for types of treatment and rehabilitation programs. Besides working with the Georgia prison system, Eber has done similar work in Colorado, Arizona, Oklahoma, and Alabama.

grant and include it in his data base, although it may take three more years, he says.

The 25-year-old Cassidy began accumulating scholarship information on file cards for his own use when he was a student at the University of San Francisco. After four years, he had four file drawers of sources—and \$20,000 in scholarships! Cassidy used the money to earn degrees in pre-medicine and international business, as well as a master's degree in chemistry from USF.

Later working toward a PhD in pathology at the University of California at San Francisco, Cassidy supported himself and his wife and supplemented his scholarships by selling scholarship information to other students looking for financial aid. He borrowed money from his parents, bought an Apple computer, and set up NSRS in his apartment. He learned to program while at USF.

He originally charged \$25 for his services, "because I wanted to keep it to the price of a case of beer." Cassidy was, however, soon swamped with work. Indeed, so many customers besieged his fledgling business Cassidy had to drop out of school to manage his creation full-time. Last year NSRS, using its one Apple and an old Digital Equipment Corporation DECWriter printer, served 1120 students. Now the company owns 12 Apples, a Corvus networking system with 20 megabytes of data storage, and Okidata and TI 810 printers. NSRS expects to process more than 6000 applications by the end of the year.

"We want to become THE institution for private money," Cassidy says firmly. With the Reagan administration's threat to cut \$9.2 billion from the federal scholarship and loan programs in the next five years, NSRS will undoubtedly attract increasing attention.

The company already re-

ceives about 1000 inquiries a month. A student fills out a 31-question application, listing scholastic interests, religion, and ancestry, and (for a \$35 fee) receives a computer print-out of relevant scholarships. The average person obtains 30 to 50 listings of private scholarships and NSRS returns a customer's money if it can't provide at least 20 sources. "So far, we refund about nine a month," Cassidy said.

Soon the company will add information grants, which are offered to students pursuing vocational and technical education. Early in 1982, Cassidy will open a London office, called The International Student Research Service, to provide American and foreign students with information on scholarships for overseas study.

Flea Market Shopping Via Computer

In the market for 10,000 pounds of hamburger? The American Meat Exchange, a computerized supermarket for volume buyers, is one of a number of new computerized trading grounds. Working like an electronic cross-reference file, the computerized flea markets link those in need of goods with suppliers.

Computer traders use large mainframes with intricate database management software programs and save time and money by cutting the number of phone calls needed to track down items. Users simply call the exchange, review the list of goods, and contact the appropriate party either directly or through the exchange.

The American Meat Exchange, located in Elmhurst, Illinois, opened for business last year with a clientele of meat dealers, supermarket

chains, and wholesale dealers. Using their own video-display terminals and printers, merchants hook into the General Electric Information Services Company each morning to enter their list of goods and prices. After reviewing the supply list, buyers type in the price they are willing to pay and the two parties begin negotiations. The computer locks out other potential buyers, while the involved parties dicker over prices and decide on shipping and packing times. When a deal is made, trader and customer receive printed copies of the transaction. Final prices are recorded by the computer, although names of the parties and terms of the agreement are kept secret. Users then pay for computer time, which averages \$75 to \$100 per hour.

Other barter systems charge according to a percent of the sale. Source 2, an electronic components flea market, receives a fee each time a deal is made on its computer lines.

Source 2 clients are mostly companies with excess stock of integrated circuits, semiconductors, and the like. Companies with parts call into Source 2, enter a list of parts, part condition (worn-out or brand-new), and prices. Shoppers phone in to see what's available. If a match is made, Source 2 receives 10% of the sale, which usually hovers between \$1500 and \$2000. Headquartered in Santa Clara, California, Source 2 recently expanded operations, opening two new offices in New Jersey and Massachusetts.

Based in Philadelphia, the newest exchange is International Real Estate Exchange (IREX), which caters to some 2500 real estate developers around the globe. Agents wheel and deal from terminals stationed in their home offices. Property listings describe land, buildings, and suggested prices.

Interested buyers call the exchange, which connects them to sellers. If property is sold, the real estate exchange is paid with a fee set at 1% of the sale. Buyers and sellers share the charge.



Thirteen-year-old Glenn Tesler of North Hollywood, California, has built a profitable family business around his personal computer.

From Play to Profit

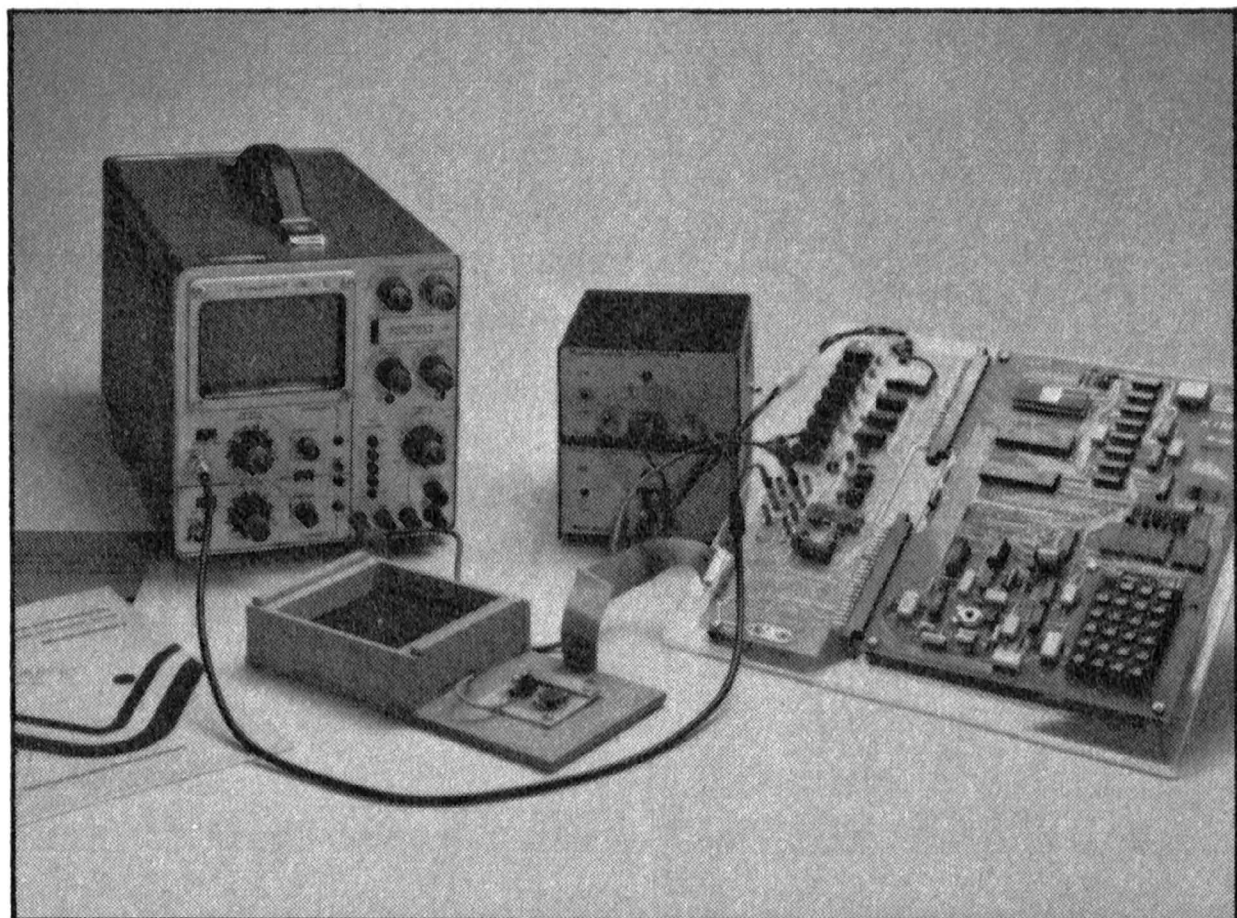
For 13-year-old Glenn Tesler, personal computers provide more than fun and games. Computers are the backbone of a commercially successful all-in-the-family business, Prosoft, that sells software out of the Teslers' North Hollywood, California, home.

Glenn was nine when he got hooked on computers. He learned by playing around at the keyboard and picking up machine language from technical books. Glenn also boned up on computers by working on timesharing systems with his father, an IBM consulting engineer. By 11, Glenn had his first computer, a Radio Shack TRS-80 Model I, and within weeks he was so proficient at it that he began using more advanced programming. Next came a disk drive, for more computer power, and, finally, a printer. During his free time, Glenn began to produce dozens of programs.

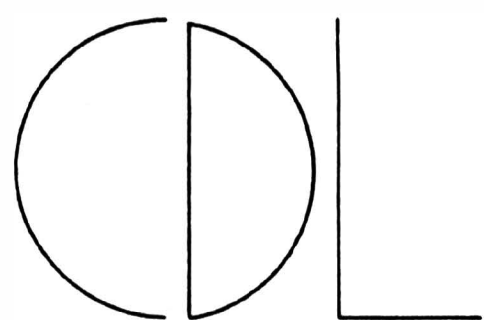
There's Faster, for instance, which took about two months to develop. It speeds up BASIC

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programs by showing the programmer how to modify the programs for maximum effectiveness.

About a year ago, with *Faster* in hand, Glenn's father, Charles, decided it was time to move into the marketplace. Tesler purchased a second TRS-80 and some other equipment and Prosoft was born. The "outside" computer interest, however, also meant he had to leave IBM, where he worked for 18 years.

"So far," says Tesler, "business is very good." *Faster* is priced at \$29.95 and after six months 250 have been sold. The more recent *Newsprint*, a word-processing program, goes for \$99.95 and some 450 of those programs have been sold.

Most Prosoft customers are home-computer hobbyists, businessmen, doctors, and universities. And Glenn's mother, Deborah, points out, "A lot of writers want *Newsprint* because it's a word-processing program."

Glenn receives royalties from Webb International, Inc., a Newport Beach, California, firm specializing in TRS-80 software while working on his new project. He is developing a product that will connect a computer and a typewriter. "It's going to be part of a word processor, and the name of the product is T-Lec," says Glenn.

"The man from Webb told us he had looked all over the Los Angeles area and decided that Glenn was the most qualified person for the job," adds Glenn's mother.

So far, Prosoft is strictly a family business. Glenn and his father team up on the technical work, developing programs. Deborah Tesler tackles the rest, including advertising. Even 11-year-old Laura and 10-year-old Scott help out by recording programs on disks, which is the initial step in producing software. For the how-

to manuals, the Teslers turn out the original copy on a computer printer and ship it to a local printer for duplicates.

From the Teslers' San Fernando Valley house, a busy industry is run: outside a pile of packages await United Parcel Service pickup and inside the phone rings constantly. Glenn is on the line for hours, handing out advice and information to people who have bought his programs. "He feels he owes it to his clients," says his mother.

How do people react when they find they are asking a 13-year-old for help? "Well," says Glenn's father, "first they have to get over the fact that it's not a girl they're talking to but a young boy (Glenn's voice is high) then they don't really care. They need help, and as long as they get it, it doesn't make any difference who it comes from. They soon find out that Glenn knows what he's talking about—that's all that counts. Sometimes when I answer the phone people tell me they don't want to talk to me but to Glenn, because he's more patient."

Last year, Glenn was the youngest winner of Rockwell International Corporation's annual computer programming contest for seventh graders in the Los Angeles school district. He also speaks to computer clubs. Still, his interest goes beyond computers. Says his father, "He is a straight A student, except in physical education and ceramics. He intends to go to college, but he won't major in computer science. There are other things in life than computers. Besides, I'd like him to major in business. It would be useful for our company." □

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The TRS 80 Model III

An affordable computer with Model I compatibility and plenty of new features.

by Ivan Berger

The TRS-80 Model I is the computer that 300,000 people (give or take a few) love to hate. They love it because it's affordable and cost-effective, and hate it for the shortcomings that make it affordable.

The system consists of several separate components (keyboard, expansion interface, video display, cassette recorder) linked by cables, each having its own power cord. The display is all uppercase because that saved a few cents in hardware cost. Despite these and many other complaints, the Model I was the first personal computer to be successfully mass-marketed.

Now we have the Model III, Tandy's replacement for the retired Model I. (Tandy is no longer manufacturing the Model I for sale in the U.S., but is continuing to make and sell Model I software and hardware enhancements.) This looks like the computer that Model I customers have dreamed about—it retains the best of Model I and eliminates the worst. Now the keyboard, display, and expansion capability are all housed in a single case. The display is much sharper and lowercase is standard with most systems.

Perhaps best of all, the Model III is largely hardware- and software-compatible with the Model I. This means TRS-80 veterans can move up without scrapping their BASIC programs or selling their peripherals. And Model III customers new to TRS-80s can take advantage of the generous supply of soft-

ware and hardware developed for the "lowly" Model I.

Though the Model III's lowest price is higher than the Model I's, it includes many useful features that cost extra on the Model I: lowercase characters, a printer interface, expansion capability, and a real-time clock. Add these to the initial cost of the Model I, and the total cost is higher than that of the Model III. Fully expanded, the two computers cost about the same.

Furthermore, the Model III gives more value: a sharper screen, better keyboard (no inadvertent double entries), the option to save and load cassette programs at 1500 bits per second (instead of the standard 500 bps), and a faster-running microprocessor (2.03 MHz instead of 1.7 MHz).

The Model III has a number of special display characters that are quite useful in games and other programs. These include the four card suits, smiling and frowning faces, a man and woman, male and female symbols, a tiny rocket ship, and a three-part symbol forming a pointing hand. Other special characters include the Greek and Japanese Kana alphabets, foreign-language letters and accent marks, and mathematical symbols.

System Software

You can choose from among any of three operating systems: Level I BASIC, Model III BASIC, and TRSDOS.

The first two are really just BASIC

interpreters. Level I BASIC comes with the \$699 system. It is a limited form of the language and occupies 4 K bytes of ROM (read-only memory). Model III BASIC is a definite step up, with a much more powerful BASIC interpreter and many enhancements to the computer's I/O (input/output) capabilities. It occupies 14 K bytes of ROM; systems start at \$999. If you're familiar with the Model I, you can think of Model III BASIC as Level II BASIC; the two languages are virtually identical.

The last option in system software is TRSDOS, the disk operating system supplied with the disk drives. This is a true operating system with a command level, a debugging monitor for advanced programmers, a deluxe form of BASIC, and, of course, disk I/O capability. These systems start at around \$1995 (one disk drive and 48 K bytes of random-access memory).

Level I vs. Model III BASIC

Level I is intended as an entry-level system, ideal for those hesitant to use a computer for fear of "breaking" it. About the worst you can do is cause a syntax error in a program. And the manual is a popular attraction in its own right; written in a sometimes whimsical style, it represents a sharp departure from the dreary "documentation" supplied by many manufacturers.

Level I BASIC is not a powerful programming system. (Radio Shack doesn't even list a memory expansion



At a Glance

Name: TRS-80 Model III

Uses

Personal computing, small businesses, professional firms, schools and universities, scientific institutions, homes

Manufacturer

Radio Shack
A Division of Tandy Corporation
1800 One Tandy Center
Fort Worth TX 76102
(817) 390-3011

Standard Features

Z80A microprocessor, integrated keyboard/display, 65-key typewriter-style keyboard, 96 ASCII display characters, 64 graphics characters, 160 special characters, 128 by 48 graphics resolution, 4 K to 48 K bytes of RAM, 4 K bytes of ROM (Level I BASIC) or 14 K bytes of ROM (Model III BASIC), cassette interface, parallel printer interface, power supply, and AC line cord

Base List Price

\$699 for 4 K RAM, Level I BASIC;
\$999 for 16 K RAM, Model III BASIC

Typical System Price

\$2495 for two-disk system with 48 K bytes of RAM and RS-232C interface

Popular Accessories

Printers, RS-232C interface, telephone interface (modem), cassette recorder, internal and external disk drives

Other Available Languages

COBOL, FORTRAN, Tiny Pascal, PILOT (teacher's aid)

for the Level I system; if you need more than 4 K bytes of RAM, you can probably use a more elaborate BASIC interpreter, too.) Level I BASIC does have graphics, cassette I/O (reliable but snail-like, at 250 bits per second), floating-point (whole numbers and decimal fractions) arithmetic, one-dimension arrays, and rudimentary string handling and error messages.

Model III BASIC, however, has far more advanced string handling, and three utilities (editing, Auto, and Trace) that can save you hours in writing and debugging your programs. Model III BASIC also has a fine tutorial manual.

In Level I, the only way to revise a program line is to rewrite it from scratch, chancing new errors as you do so; Model III BASIC lets you make changes within a line quite easily. The Auto command automatically supplies correctly sequenced line numbers, spaced as you want them—another time-saver. And the Trace feature lets you view the sequence of steps a program follows during execution, a help in pinpointing programming errors quickly. Model III BASIC also stores programs more compactly than Level I, thus conserving memory.

For math programs, Model III BASIC offers accuracy up to 16 digits (instead of Level I's 6-digit accuracy) and allows multidimensioned arrays. It also gives you automatic key repeat, access to lowercase letters, an optional RS-232C serial interface, and a real-

time clock (which can be displayed or read by programs).

Model III BASIC incorporates all features of the Model I's Level II BASIC, so most Level II programs will run under it. Exceptions include:

- programs which use the four arrows as display characters (in the Model III these are displayed as standard characters—left and right brackets, caret, and backslash)
- programs using shifted characters or the shift keys (the Model III treats its right shift key differently)
- programs coming close to the limits of RAM (Model III BASIC leaves the user 258 fewer bytes than does Level II)
- timing loops may have to be adjusted, since the Model III runs faster than the Model I

The differences aren't too bothersome; programs can be written to recognize which model they're running on and adjust accordingly.

Model III BASIC eliminates one nuisance present in Levels I and II: operations using the cassette, line-printer, or serial interfaces can now be interrupted by pressing the Break key, so they no longer hang you up if external devices are unavailable or inoperative.

III has a new input/output structure, as compared to the Model I. As a result, Model I programs with machine-language I/O routines will not run on the Model III without modification. However, most programs written exclusively in BASIC will run without modification.

Disk System (TRSDOS)

If you can afford it—and you're serious about computers—you'll wind up with floppy disks. Disks hold a lot of information and let you access it far more quickly than cassettes do, which in turn, allows programs to use more sophisticated techniques: instead of the whole program occupying RAM at once, only the modules actually in use need to be in RAM, since they can be replaced by any other needed modules within seconds.

The Model III was designed with floppy-disk convenience in mind. Thanks to its built-in drive slots, a two-disk system is as compact as a nondisk one, and the drives are easy to reach. The drives are double-density, which means they hold about twice as much (175 K bytes) as the same size disks on the Model I and they load and save the data faster.

- DUMP and LOAD copy machine-language programs from RAM to disk and back
- PURGE lets you quickly and selectively remove files from a disk
- KILL lets you delete specific files or a whole class of files
- BACKUP copies an entire disk

Model I disk files can be transferred onto Model III disks using the CONVERT utility program. However, no way is provided to accomplish the reverse task (Model III to Model I).

There are still more commands, for a total of about 45. You'll be grateful for TRSDOS's HELP command: type HELP DUMP, for example, and you get a brief summary of DUMP's function and how to use it. There are many potentially informative error messages, too, but they are delivered in such nonhelpful forms as "ERROR 24". If you then type "ERROR 24", you'll get a message explaining it, but TRSDOS should automatically give you the descriptive message. In practice, though, you soon get familiar with the common error numbers.

Disk BASIC has many features not found in Model III BASIC. Disk file handling alone makes this BASIC more powerful, since you can fill a disk with more data files than your RAM can hold, and call in only the files or records you need at any moment. But Disk BASIC also has about two dozen other new functions: you can disable the Break key so users can't interrupt or read your programs; you can return to TRSDOS with a command (to switch from BASIC to some other program, for example); and you can read the disk directory without "leaving" BASIC.

String handling is enhanced with the MID\$, INSTR, and LINE INPUT functions. You can also define your own BASIC functions (DEF FN) and renumber (but not reorder) your BASIC program lines.

Model III Disk BASIC introduces several other commands not found in the Model I: a command to compress programs, removing REM statements and spaces between BASIC keywords to save memory; another that sorts arrays into alphabetical or numerical order; yet another that cross-references

Model III disks are double-density, each holding about 175,000 characters of data.

Model III BASIC gives you a great deal of software control over input and output, including programmable RS-232C characteristics, printer line width and page length, cursor character, and cassette transfer rate (500 or 1500 bps). A special key sequence causes the display to be copied to the printer at any time during program execution. You can route input or output from one device to another. For example, you might want all printer output to go to the RS-232C interface; that's a simple way to "dump" a program listing to another computer.

All this is possible because the Model

With the disk system comes a powerful operating system, TRSDOS, and a more powerful version of BASIC—actually an enhancement of Model III BASIC. TRSDOS has many commands relating to disk I/O:

- APPEND adds one file to the end of another
- ATTRIB lets you protect files against unauthorized access
- COPY duplicates a file on another disk
- CREATE clears space for a file to be written later
- DIR gives you information about the files on a disk

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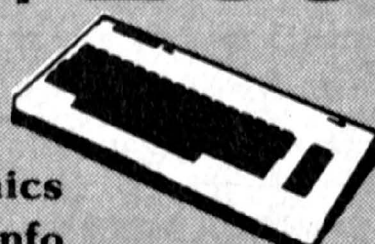
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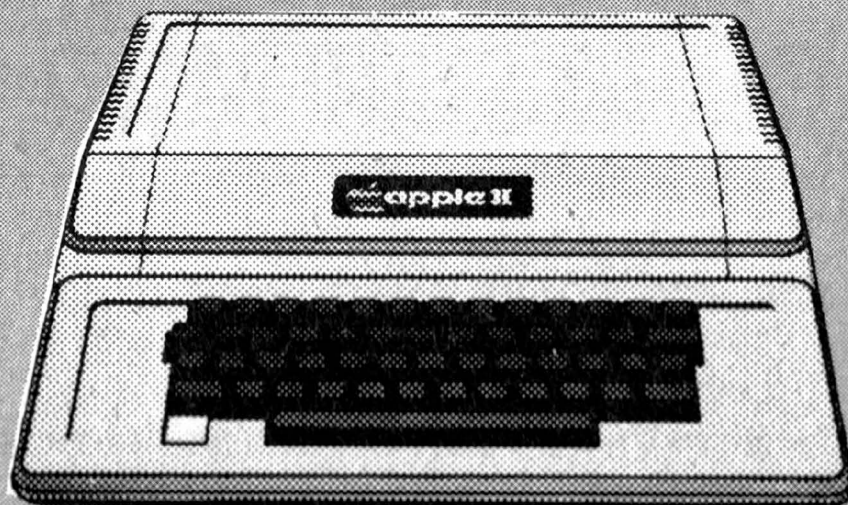
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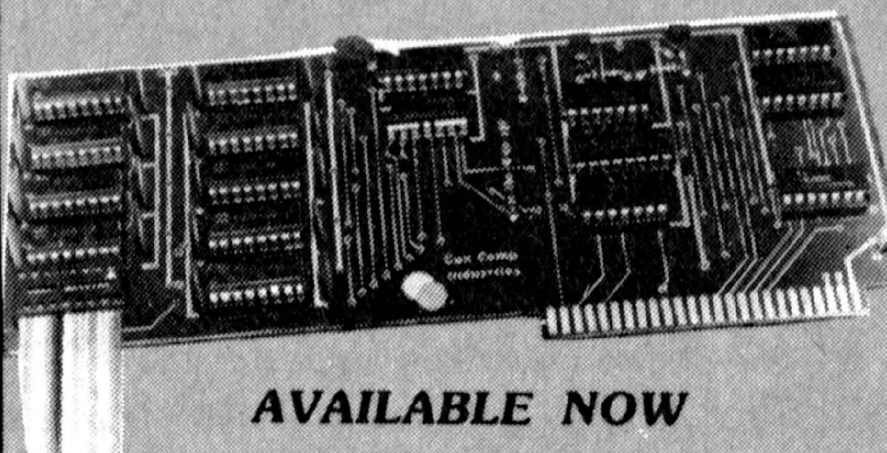
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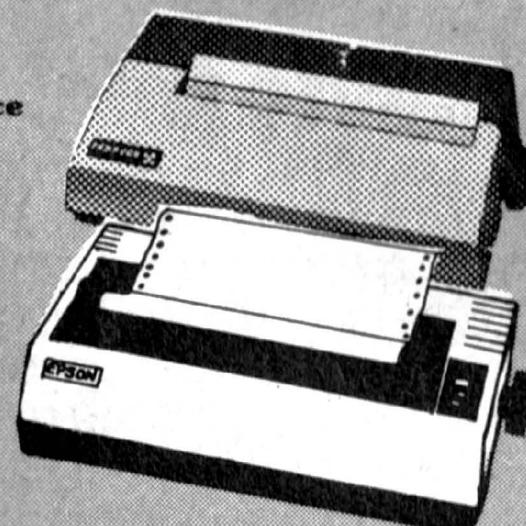
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program lines, telling you which lines of a program contain a specific variable, command, or other string; a date-conversion command that converts dates back and forth between the usual month/day/year form and a year/day-of-year sequence, which is easier for some programs to handle.

Conclusion

The TRS-80 Model III is a very good computer. It's supported by excellent system software from Radio Shack and additional software from other sources.

It's user-friendly. On the hardware side, the keyboard feels good, the display screen is crisp and easy to read, and the disk drives (at least the first two) appear to be reliable. From the software standpoint, its BASIC interpreters add new and useful functions to the already easy-to-use and powerful versions of Microsoft BASIC.

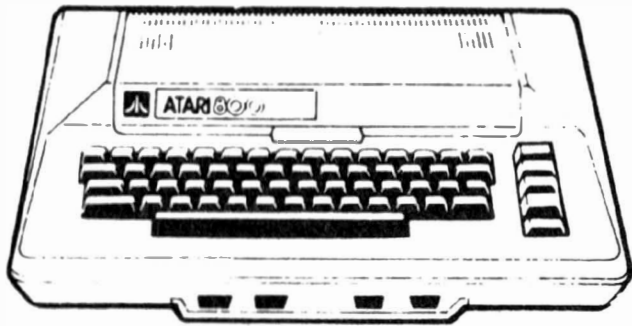
As with any computer, there are a few complaints. The display could offer fancier graphics. The DEBUG program in TRSDOS has a new feature (direct access to disk files) but is now limited in the addresses it can read. And Model III versions of some disk programs (such as VisiCalc and Scripsit) limit the number of backups you can make. The connections for peripherals are placed underneath the machine. It would have been more convenient if they'd been placed on the spacious back panel. Attaching or removing a cable can be awkward.

My Model III has worked reliably for eight months, for an average of about 10 hours a day. The drives are a bit noisy and they wear the disks visibly, but I haven't had a single disk error. A loose connection has developed in the video circuit, which sometimes dims the display until I lightly tap the computer. Both problems can easily wait until the next time I'm leaving town long enough to return the system to Radio Shack for repair.

This is the third computer I've owned—and the first I've really enjoyed using. ☐

Ivan Berger is a New York-based writer whose work has appeared in numerous consumer magazines.

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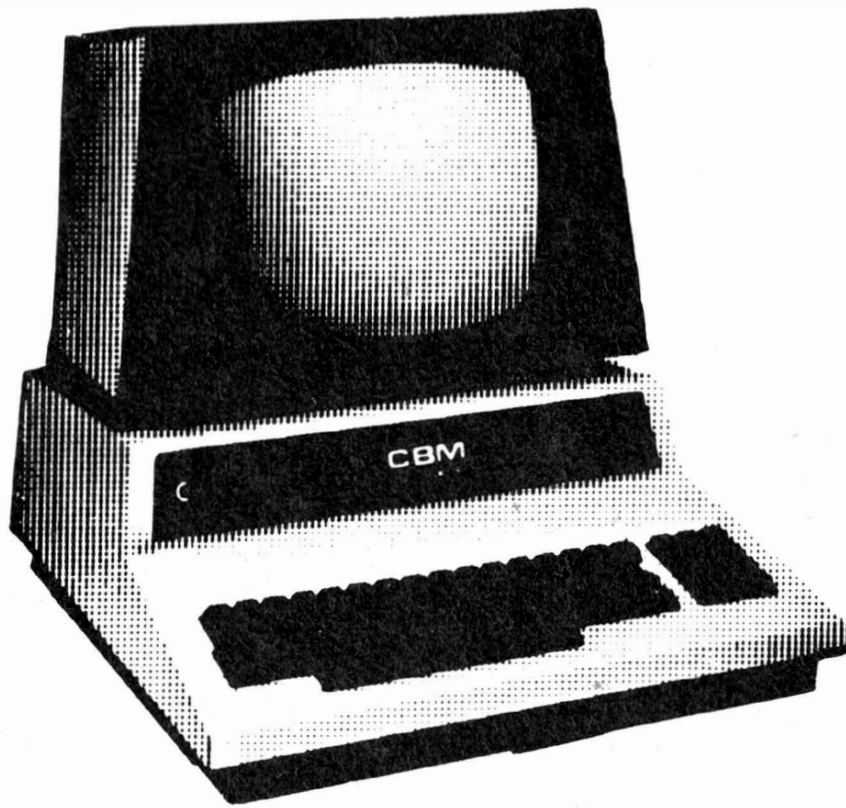


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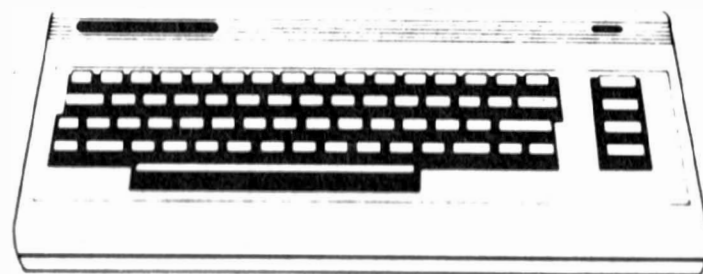


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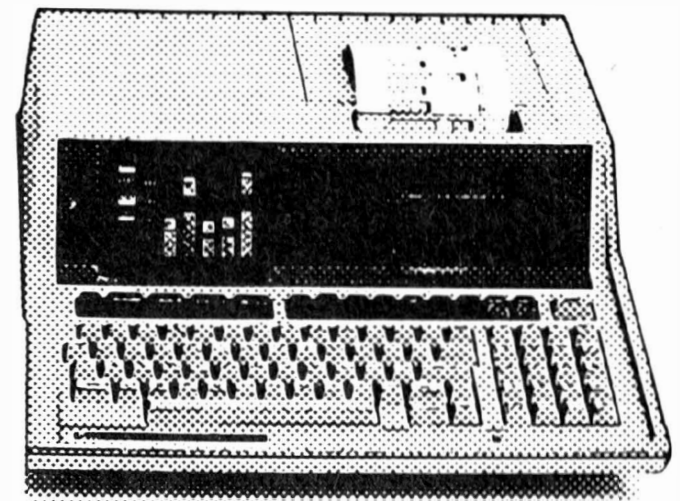
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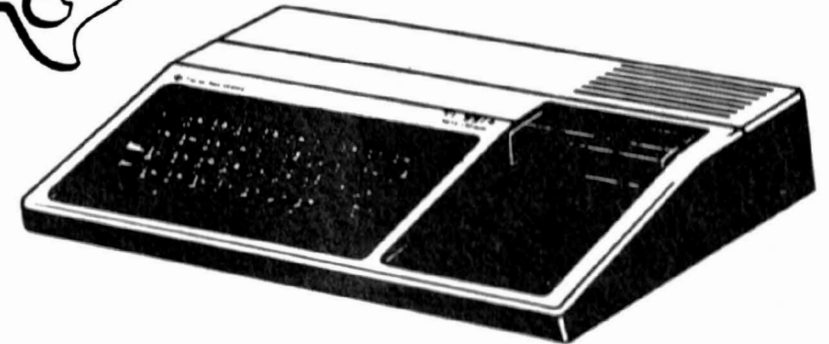


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The Commodore Computers

A worldwide leader in small computer sales, Commodore is out to corner a big piece of the American market

by Stan Miastkowski

Ask someone to name the second-best-selling personal computer worldwide and chances are he *won't* mention Commodore. But the Commodore PET and CBM *are* number two in the global market.

Commodore survived the massive "shakeout" that killed off a number of small companies during the mid 1970s. Since entering the market in 1976, Commodore has sold some 150,000 units. Commodore's \$299 VIC-20 has set a price and feature standard as yet unmatched in the industry.

Until recently, Commodore flexed its marketing muscle primarily in Europe. In Britain, its computers are *the* major brand. Expect to hear much more from this manufacturer in the near future.

The Commodore PET made its inauspicious American debut in 1977. A vigorous marketing campaign failed to overcome two major obstacles: the campaign was premature (Americans hadn't accepted the viability of personal computers) and the PET's physical design was ill-conceived.

Although its technical capabilities were good, it was introduced with a strange keyboard that used tiny calculator-style keys, had no peripherals, and had almost no software. These factors virtually killed sales in the U.S., though Commodore quickly corrected these deficiencies. A standard typewriter-style keyboard was added about a year later and a new business

model called the CBM was introduced in 1978.

The PET

The now-official word from Commodore is that PET stands for Personal Electronic Transaction machine. Actually, PET was designed about the time of the pet rock craze, and designers hoped that it would approach the popularity of pet rocks.

Unfortunately, it was wishful thinking. Although a reliable and well-designed machine, the PET's major problem in the U.S. seems to be its lack of uniqueness in comparison with brands more generally available.

The PET's built-in black-and-white monitor displays 40 characters across. Unlike machines such as the Apple, the PET can't be upgraded to display the 80-character line that's a virtual necessity for serious business or word-processing applications. Also, though many special graphics characters are available from the keyboard, there's no way to generate the high-resolution graphics popular today.

Although the PET uses the 6502 microprocessor found in many of today's personal computers, little software is available for it. Unfortunately, that's the Catch-22 facing manufacturers who design computers that won't accept other people's software. Without the product acceptance, there's little software; and without much software

available, few people seem interested in buying the machine.

The CBM

The CBM (Commodore Business Machine) is a thoughtfully designed computer for small-business and professional use. Besides having more memory than the PET (up to 32 K bytes), the CBM's major feature is a built-in green-phosphor video screen that displays the full 80-character line that's all-important for professional applications. (The green-phosphor screen is easier on the eyes than a standard black-and-white screen.) The CBM also displays both upper and lowercase letters—furthering its utility in the professions.

Accessories

The PET and CBM have something unique to personal computers—*intelligent peripherals*. This means that the machines' floppy-disk drives have their own built-in microprocessor. As a result, Commodore's disk drives are very convenient to use.

An intelligent peripheral has several advantages: unlike other personal computers, the software required to run a disk drive (called the DOS, for disk operating system) requires no space in the computer's main memory—leaving extra room for programs. In addition, the floppy-disk drive can store and



At a Glance

Name: PET 4000, CBM 8000, VIC-20
Use

Personal computing — homes, schools, small businesses

Manufacturer

Commodore Business Machines, Inc.
681 Moore Road
King of Prussia, PA 19046
(215) 337-7100

Standard Features

All models use 6502 microprocessors

PET 4000

Typewriter-style keyboard with separate numeric-entry cluster, 12-inch green-phosphor display with upper and lowercase and 64 graphics characters, 40 characters per line, 16 or 32 K bytes of RAM, 18 K bytes of ROM including BASIC, IEEE-488 standard peripheral interface, 8-bit user interface port, and dual cassette interface

CBM 8000

Same features as the PET 4000, 80 character/line display, 128 graphics characters, and 32 K bytes of RAM

VIC-20

Typewriter-style keyboard with four programmable function keys, radio frequency (RF) output for television, color and high-resolution graphics capability, upper and lowercase characters, three-tone generators plus television sound, serial interface, cassette interface, 5 K bytes of RAM, 16 K bytes of ROM, expandable to 32 K bytes of total ROM plus RAM, BASIC in ROM

Base List Price

PET 4000, \$995; CBM 8000, \$1495; VIC-20, \$299

Typical System Price

CBM 8000 with one disk drive — \$2790

Popular Accessories

Single and dual 5¼-inch floppy-disk drives, dual 8-inch floppy-disk drives, telecommunications modem, printer, game controllers, light pen, and plug-in ROM programs

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Pascal and PILOT

retrieve information while you're doing something else on the main computer. This capability doesn't come cheap—the 4040 dual 5¼-inch drive lists for \$1295, while the 8050 (which stores twice as much information) costs \$1695.

The VIC-20

Any overview of Commodore's product line would be incomplete without a look at the company's latest computer—the VIC-20. The VIC retails for \$299 and comes with full-color graphics and upper and lowercase letters. Available in Japan for more than a year, the VIC is now starting to appear in computer stores (and even retail department stores) in the U.S. VIC-20 marketing manager Mike Tomczyk expects the VIC to become the biggest-selling personal computer ever and a major factor in making small computers an accepted "home appliance." (Watch for an in-depth review of the VIC in an upcoming issue of *Popular Computing*.)

Whither Commodore?

Although the PET still enjoys a loyal European following, the company seems to be putting its U.S. marketing efforts behind the VIC-20 and the CBM. After considerable grumbling by its dealers about an alleged lack of support from Commodore, the company appears to be mending its ways and will likely convert its background into a solid stance in the competitive marketplace.

Only in the domain of personal computers can a company with five or more years' experience be called an "old-timer." Commodore already qualifies and is likely to be around even longer.

□

Stan Miastkowski is managing editor of *Popular Computing*.

The Apple II

A computer for connoisseurs that's supported by an extensive line of outside accessories and programs.

by George Stewart

Of the four leading manufacturers of popular computers, only Apple Computer Inc. had its origins in the computer-kit market. In the company's early days microcomputers were the sole property of electronics hobbyists who were handy with soldering guns and fluent in machine language. The influence of that period is evident in the company's second-generation microcomputer, the Apple II.

It's not that the Apple II requires any more technical know-how than do the TRS-80, Atari, or PET models. For the first-time user, the Apple II is probably one of the easiest units to set up and operate. However, much more than its competitors, the Apple II also accommodates the needs of the expert users—engineers, professional programmers, and hobbyists. Here are some examples:

- Apple encourages you to open up the computer case to see what's inside (the lid pops open). Other computer manufacturers discourage this practice by using screws and plastic seals.
- Apple also encourages you to upgrade your system by adding additional memory or installing a printer interface. Other computer manufacturers recommend that you let *their* technicians do the work, or they provide encased modules that plug in, not requiring you to open the computer.

- The Apple II includes expansion slots for up to eight accessories—making it easy for outside manufacturers to adapt their products to the computer. Compared to the Apple II, other personal computers provide limited room for expansion, except for their own accessories, of course.

- On a technical level, the Apple II system is well documented, which encourages outsiders to develop hardware and software for it. Most other personal-computer manufacturers either don't provide such information or issue it in bits and pieces.

Many of these differences may not seem important, but they have been instrumental in making the Apple II the best-supported personal computer around, in terms of hardware and software products available.

If that's true, why doesn't everyone get an Apple II? Because there are many other factors that influence an individual's buying decision. The Apple II is not the least expensive microcomputer on the market, and for customers who are concerned about sales and service, Radio Shack has more stores supporting its products. Also, the Apple II may not be the most attractive computer for certain specific applications. And some of Apple's attractions that appeal to technical users may frighten a person without a com-

puter or electronics background.

Apple Features

There are two versions of the Apple and many variations of each version. The basic system is contained in a compact, lightweight case. The built-in keyboard has typewriter-style keys and allows entry of 91 of the 96 standard ASCII (American Standard Code for Information Interchange) characters—a useful capability for programmers and special applications. However, all letters are displayed on the screen as uppercase. The unit will accommodate 16, 32, or 48 K bytes of RAM (random-access memory). Also included are a cassette interface for program and data storage on a cassette recorder, a speaker for sound generation, color-graphics capability, game-controller connections, and an output for a color or black-and-white video monitor. The monitor is not included. A special adapter is needed for connection to an ordinary television set. The unit plugs into any 120-volt AC power outlet (USA models).

Beyond these basics, you have two options—the Apple II or the Apple II Plus. The Apple II includes a limited version of BASIC called Integer BASIC. It can handle only whole numbers ranging from -32767 to +32767 and lacks many of the advanced mathematical functions. It offers low-resolution graphics commands and



At a Glance

Name: Apple II and Apple II Plus
Use

Personal computing, small businesses, professional firms, schools and universities, scientific institutions, homes

Manufacturer

Apple Computer Inc.
10260 Bandley Drive
Cupertino CA 95014
(408) 996-1010

Standard Features

6502 microprocessor, 52-key typewriter-style keyboard, built-in speaker, cassette interface, game input/output capability, color-graphics capability, 16 to 48 K bytes of RAM, power supply, and AC line cord. Apple II includes Integer BASIC, machine-language monitor, mini-assembler, and disassembler, all in

ROM. Apple II Plus includes Applesoft extended BASIC, machine-language monitor, and disassembler, all in ROM

Base List Price

\$1330 for Apple II or II Plus with 16 K bytes of RAM

Typical System Price

Single disk system, Apple II Plus with 32 K bytes of RAM—\$2075

Popular Accessories

Color-display monitor (the computer may also connect to a television set through an adapter), 5¼-inch floppy-disk drives and controller, Silentype printer, telephone modem, serial interface card, game controllers, language system card

Other Languages Available

Pascal, FORTRAN, LISP, COBOL, FORTH, PILOT (teacher's aid), Logo

generally operates faster than Applesoft BASIC, described below. The Apple II also includes useful software tools for the advanced programmer: a machine-language monitor, a mini-assembler, and a disassembler. These help you to program the Apple on a machine level (memory locations, input/output ports, and binary arithmetic operations). Whenever you start or reset the Apple II, you enter the “unfriendly” monitor; you have to press a few keys to get into “friendly” Integer BASIC.

The Apple II Plus includes a deluxe version of BASIC called Applesoft. It can handle whole numbers and decimal fractions and offers many useful mathematical functions, plus low- and high-resolution graphics commands. The Apple II Plus doesn't include the mini-assembler but does give you the monitor and the disassembler. When you start or reset the Apple II Plus, you automatically enter the friendly world of Applesoft BASIC.

Options

Because of the built-in expansion slots mentioned previously, many optional devices are available for both versions of the Apple II. They can have a major impact on the usefulness and power of the system. Here are a few:

- The *disk controller card* allows connection of up to two floppy-disk drives, each of which can contain 143 K bytes of on-line storage. Up to

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Dental (PAS-3)	\$849/\$40	
ASYST DESIGN		
Prof Time Accounting	\$549/\$40	
General Subroutine	\$269/\$40	
Application Utilities	\$439/\$40	
COMPLETE BUS. SYSTEMS		
Creator	\$269/\$25	
Reporter	\$169/\$20	
Both	\$399/\$45	
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Fabs (B-tree)	\$159/\$20	
UltraSort II	\$159/\$25	
COMPUTER PATHWAYS		
Pearl (level 1)	\$ 99/\$25	
Pearl (level 2)	\$299/\$40	
Pearl (level 3)	\$549/\$50	
DIGITAL RESEARCH		
CP/M 2.2		
NorthStar	\$149/\$25	
TRS-80 Model II (P+T)	\$159/\$35	
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Z-Sid	\$ 90/\$15	
Tex	\$ 90/\$15	
DeSpool	\$ 50/\$10	
✓ CB-80	\$459/\$35	
✓ CBasic-2	\$ 98/\$20	
D.M.A.		
Ascom	\$149/\$15	
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CBS	\$369/\$45	
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WordStar/Mail-Merge	\$419/\$85	
DataStar	\$249/\$60	
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SuperSort I	\$199/\$40	
Spell Star	\$175/\$40	
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Basic Compiler	\$329	
Fortran-80	\$349	
Cobol-80	\$574	
M-Sort	\$124	
Macro-80	\$144	
Edit-80	\$ 84	
MuSimp/MuMath	\$224	
MuLisp-80	\$174	
MICROTAX		
✓ Individual	\$250	
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✓ Partnership	\$750	
✓ Package	\$1500	
ORGANIC SOFTWARE		
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Adapt (CDOS to CP/M)	\$ 69/\$na	
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STRUCTURED SYSTEMS		
✓ GL or AR or AP or Pay	\$849/\$40	
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Fortran w/Ratfor	\$289/\$35	
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✓ Star Edit	\$189/\$30	
Other	less 10%	
TCS		
GL or AR or AP or Pay	\$ 79/\$25	
All 4	\$269/\$99	
Compiled each	\$ 99/\$25	
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Mince	\$149/\$25	
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Both	\$249/\$50	
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"C" Compiler	\$600/\$30	
Pascal (incl "C")	\$850/\$45	
"DATA BASE"		
FMS-80	\$649/\$45	
✓ dBASE II	\$595/\$50	
Condor II	\$899/\$50	
✓ Access 80 Level 1	\$249	
✓ Access 80 Level 2	\$429	
✓ Access 80 Level 3	\$679	
Optimum	\$749/\$50	
"PASCAL"		
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Pascal/Z	\$349/\$30	
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Pascal/M	\$189/\$20	
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Magic Wand	\$289/\$45	
Spell Binder	\$349/\$45	
"OTHER GOODIES"		
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Forecaster	\$199/\$na	
✓ Micro Plan	\$419/\$na	
✓ The Last One	\$549/\$na	
SuperCalc	\$269/\$50	
Target	\$189/\$30	
BSTAM	\$149/\$15	
BSTMS	\$149/\$15	
Tiny C	\$ 89/\$50	
Tiny "C" Compiler	\$229/\$50	
Nevada Cobol	\$129/\$25	
MicroStat	\$224/\$25	
Vedit	\$105/\$15	
MiniModel	\$449/\$50	
StatPak	\$449/\$40	
Micro B+	\$229/\$20	
Raid	\$224/\$35	
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String/80 (source)	\$279/\$na	
ISIS II	\$199/\$50	
Plan 80	\$269/\$30	
APPLE II®		
INFO UNLIMITED		
✓ EasyWriter	\$199	
✓ Datadex	\$249	
Other	less 15%	
MICROSOFT		
✓ Softcard (Z-80 CP/M)	\$279	
Fortran	\$179	
Cobol	\$499	
✓ Tasc	\$139	
MICROPRO		
Wordstar	\$269	
MailMerge	\$ 99	
Wordstar/MailMerge	\$349	
SuperSort I	\$159	
✓ Spellstar	\$129	
PERSONAL SOFTWARE		
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Desktop/Plan II	\$159	
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Visidex	\$159	
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three controllers (six drives) may be added to the Apple II or II Plus.

- The *language system card* allows you to load another language package (such as Pascal or FORTRAN) from disk into memory in place of the ROM (read-only memory) language (Applesoft or Integer BASIC). All of your ordinary RAM is still available for your own programs and data.

- The *parallel interface card* lets you connect compatible devices such as line printers to the Apple II.

- The *serial interface card* allows connection of other types of printers and compatible equipment.

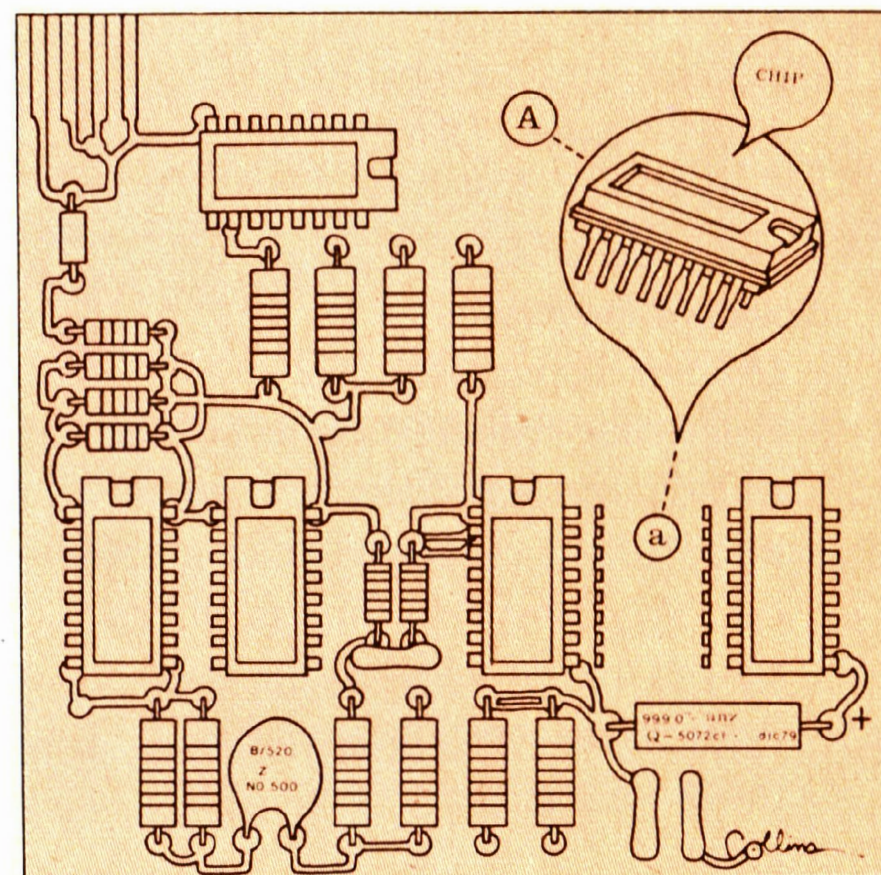
- The *telephone modem card* lets you use your computer to communicate with another one via the telephone lines.

Beyond Apple Computer Inc.

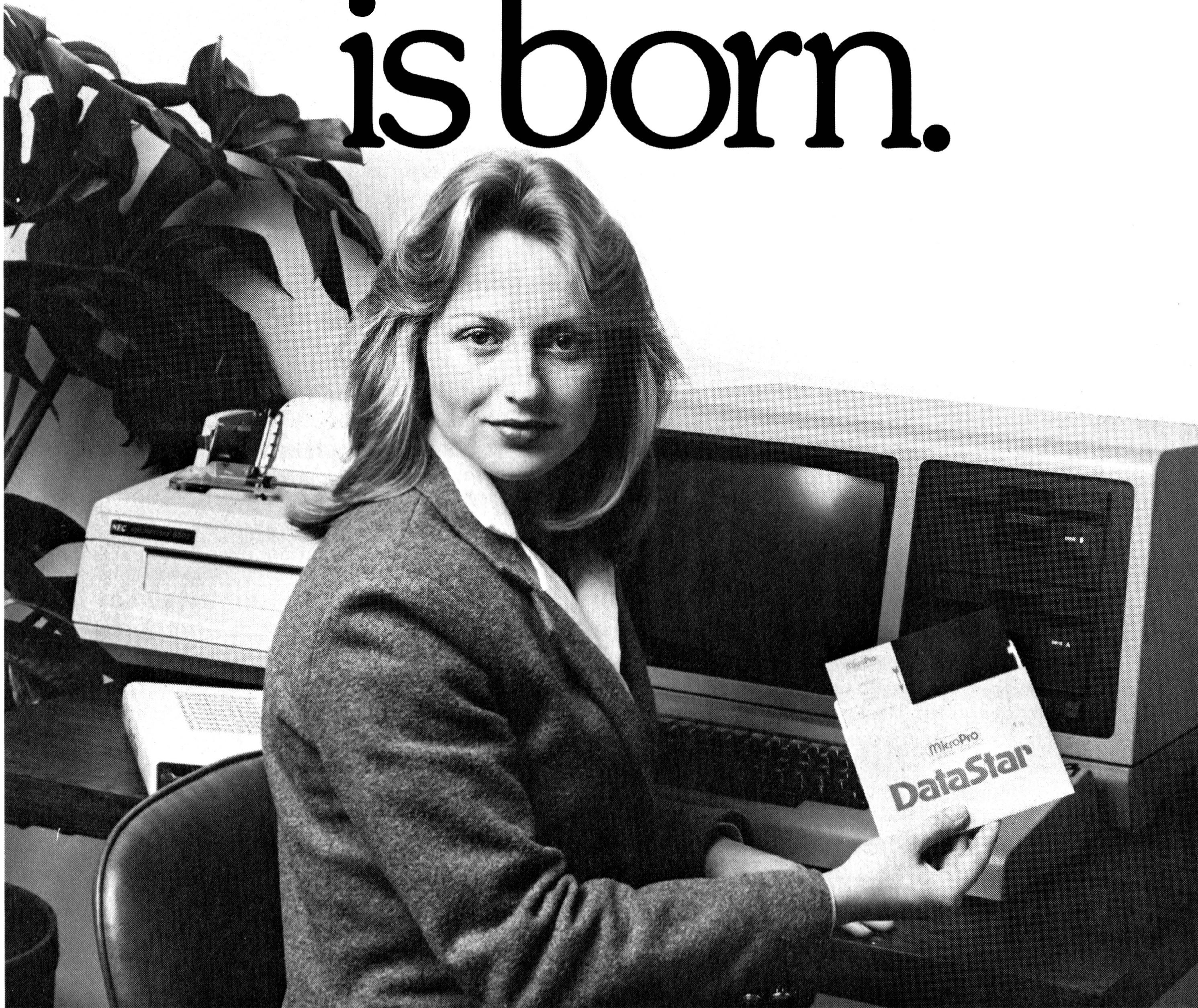
Apple Computer Inc. encourages product support from outside manufacturers and programmers. As a result, there is a cornucopia of devices and programs available, everything from videodisc controllers to voice synthesizers and from the ubiquitous CP/M disk operating system to innovative programming languages like FORTH and Logo.

In summary, the Apple II and Apple II Plus computers are technically superb. They're definitely for the "smart" buyer who doesn't mind paying a little extra. □

George Stewart is a technical editor for Popular Computing.



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Telecomputing

by Mark Dahmke

Last month's column featured telecomputing basics—a list of what you need to get started and a quick overview of available services. This month, *Popular Computing* takes an in-depth look at one of the most popular services and what it has to offer.

The Source

The Source was the first telecomputing service for home users of personal computers. However, when the company put its first mainframe computer "online," few users had the equipment to hook up, or even knew the service existed. That situation quickly changed when the company was purchased by Reader's Digest Corporation.

Infused with new blood and money from the powerful Pleasantville, New York, publisher, The Source has added more and more computer power to its system as the number of users has grown over the past year. Response time from the large systems located in suburban Washington, D.C., has been speeded up, solving one of The Source's early problems. When you're paying for telecomputing services on an hourly basis, it can be frustrating to sit and twiddle your thumbs for 30 seconds while the computer looks for your information.

Source Services

Because The Source is aimed at a general-consumer market, a long list of services is available. The following sample will give you a brief idea of the scope:

- AIRSCHED**—By typing in your origin and destination cities, you receive a complete list of all flights between the points. In addition, you can make reservations and pay for tickets (via charge card) through The Source's Travel Club, which lists special vacation packages and other deals.

- BARTER**—Want to trade your computer equipment for something else? You can do it through the barter network. (The listings can be pretty exotic—recently, a major corporation offered travel time on its corporate aircraft in exchange for heavy construction equipment.)

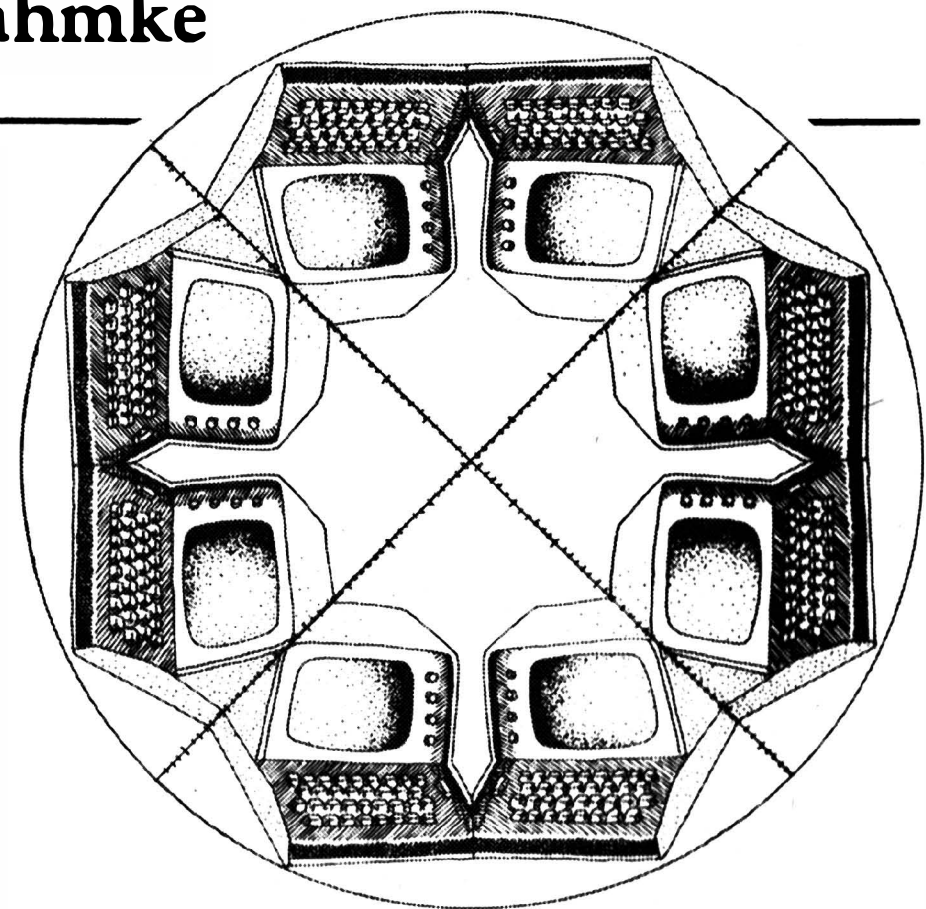
- BIZDEX**—A wealth of business, financial, and tax information is at your fingertips with this comprehensive database. A recent addition to the package is a powerful business-modeling program that allows anyone (no programming experience needed) to generate growth models and solve common management and scheduling problems.

- CAREER NETWORK**—Whether you're searching for a job or looking for someone to fill a position, the career network can help. You can look for applicants or place help-wanted ads under specific categories.

- CHAT**—Hold a two-way "conversation" with any other user who's logged onto the system. You type a message, then the other person types one, and so on. It's a fast, effective way to communicate with users who have similar interests.

- INFORMATION ON DEMAND**—Want to research some arcane subject or service? IOD will do it for you and send the information directly to your door. This service can be expensive, but it's invaluable for anyone who could use a personal researcher.

- MAIL**—One of the most popular services available on The Source, MAIL allows you to exchange messages with other Source users, regardless of whether or not the "addressee" is logged on when you enter your "letter."



- MEDICAL ADVICE**—This home health-care database is a recent addition. Although it does warn you to see a physician if the problem goes beyond the scope of the available information, it can help diagnose common health-related problems.

- MONEY SAVERS**—After the initial charge for joining the service, you can shop for virtually anything, pay for it with your charge card, and have it shipped directly to you. Users say prices are below retail.

- UPI**—The United Press International database is the largest and fastest-changing resource on the system. It allows you to read virtually any information from the UPI wires, including news, weather, and sports, plus a long list of newspaper columns (often available days before they appear in your local newspaper). You can also read bulletins and complete stories minutes after they've been filed by news reporters.

Getting on The Source

All telecomputing-service hook-ups require a telephone modem and terminal software connected to a personal computer. Connection charges are \$15 an hour during prime daylight hours, \$4.25 an hour in the evening, and \$2.75 an hour during the early-morning hours. For more information, write:

Source Telecomputing Corporation
1616 Anderson Rd.
McLean, VA 22102, or call:
(703) 821-6660

A sample listing of services available on The Source.

THE SOURCE

Data Liball
Advanced Applications & Programs
Advice Column
Airschedules
Announcements
Astrology Library
Aware Financial Service Glossary
Barter-Trade Network
Bridge According to Throop
Business & Finance
Calculator
Career Network
Classified Ads
Consumer Information
Cross X-Assemblers
Dining Out: Washington, D.C.
New York City
Continental U.S. & Canada
Discount Shopping Service (Money Savers)
Education
Energy Saving News & Tips
Financial Modeling for Business Planning
Financial News
Games
Home Entertainment
Information On Demand
Mail
Mail Delivery
Medical Advice
Movies Reviews by Jay A. Brown
Music To Order
New York Times: News Summary
Business Summary
New York Times Consumer Data Base
Personal Calendar & Notebook
Personal Finance
Political Action Report
Portfolio Management
Radio Programs To Order
Raylux Financial Services
Science & Engineering
Self-Perception
Smithsonian Exhibits and Touring Exhibits
Special Applications
Sports
Student Aid
Suggestion Box
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Unistox
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Voicegram
Weather
Wine
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DATA LORE
INFO AIRSCHED
DATA ANNOUN
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DATA GLOSS
BARTER
DATA BRIDGE
DATA BIZDEX
DATA CALCUL
EMPLOY
DATA CLASSI
DATA CONSUM
INFO X-ASSEMBLERS
RESTGD
NYRESTGD
USREST
DATA BUCKS
DATA EDUCAT
ENERGY
INFO MODEL1
DATA BIZDEX
DATA GAMES
DATA HOMENT
DATA IOD
DATA MAIL
INFO DATAPOST
INFO CARE
MOVIES
MUSICSOURCE
DATA NYTNS
DATA NYTBNS
NYTCDB
DATA PERSON
DATA PERSFI
DATA PAR
DATA FOLDEX
RADIO SOURCE
DATA FINANCIAL
DATA SCIENG
PLAY ICHING
DATA MUSEUM
DATA COMPUDEX
DATA SPORTS
COLLEGE CASH
DATA SUGBOX
DATA TRAVEL
DATA UNISTOX
DATA DANNEWS, DATA
UPI
DATA VOICEGRAM
DATA WEATHR
WINE
WISDOM

Mark Dahmke is a consulting editor for Popular Computing.

"Telecomputing" is a monthly column designed to introduce you to a variety of computing possibilities "across the wires." Comments or questions should be sent to Telecomputing, POB 397, Hancock NH 03449. Source users can send mail to TCG847.

Programs and Books For Beginners

Everything you need to know to get started programming your own computer. Nine brand-new books, each jam-packed with easy-to-understand info for beginners, laymen, novices, general consumers who want to know how to make a computer work for them. Good for advanced novices and programmers too. These handy manuals, guides and program sourcebooks are crammed with hundreds of tips, tricks, secrets, insights, shortcuts and techniques, plus hundreds of tested, ready-to-run programs.

Color & Pocket

TRS-80 Color Computer. TRS-80 Pocket Computer. Sharp PC-1211 Pocket Computer. Three of the most popular computers for beginners. Among our 9 freshly-written books are scores of programs, tips, tricks and learn-by-doing instructions for beginners.

BASIC language

BASIC Made Easy, easiest way yet to learn the world's most popular computer language, 140 pages. **\$8.95**

Universal BASIC Coding Form, programming worksheets make writing software a breeze, 40-sheet pad. **\$2.95**

Pocket Computer

50 Programs in BASIC for the Home, School & Office—2nd Edition, useful plug-in-and-run software, for the Pocket Computer, 96 pages. **\$9.95**

50 MORE Programs in BASIC for the Home, School & Office, sourcebook of tested ready-to-run software, for the Pocket Computer. 96 pages. **\$9.95**

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The Atari 800

It outshines all major competitors in sound and graphics capabilities.

by Kathy Neale

Never buy a computer unless it has hardware, software, and communications capabilities. The Atari 800 has all three.

The Hardware

The Atari 800 has graphics and sound capabilities not possessed by any other desktop computer. In addition to its 6502 microprocessor chip, the Atari has three special-function chips to control the video-screen display. And the Atari has dot graphics as well as 29 built-in graphics characters. Its color graphics are faster, finer, and exhibit less "flickering" than those of the other major small computers.

The basic machine comes with 16 K bytes of RAM (random-access memory)—which is enough to run cassette-loaded games. Expanding the memory capability is easy: it comes in 16 K-byte plug-in modules. You can add up to two modules, for a total capacity of 48 K bytes of RAM.

The Software

However impressive the technical specifications, a computer isn't worth much without software. Admittedly, the Atari does not have as much software as other small computers, but its entry into the computer marketplace is relatively recent, and the number of programs for the Atari is growing rapidly.

It's been easy to convert existing Apple and Commodore PET programs to the Atari because it uses the same 6502 computer chip as the Apple and the PET. One of the first programs to be converted was Personal Software's VisiCalc, the best-selling software package of all time. Four other new financial software packages—VisiPlot, VisiTrend, VisiDex, and VisiTerm—have yet to be converted. (For a review of these four packages, see "Beyond VisiCalc," page 38.)

Many firms have begun to develop software specifically for the Atari. Among these are Atari Inc., The Code Works, DataSoft, Dynacomp, Eastern Software House, and Santa Cruz Software. Other firms, including Automated Simulations, On-Line Systems, and Personal Software, are testing the waters with only one or two programs for the Atari.

The Best Games

Atari software can be loosely divided into three categories: games, educational software, and business software. And despite Apple's early lead, Atari may soon reign supreme at games. The reasons are Atari's missile graphics system and Atari itself.

The Atari video screen can be subdivided into a dozen or more smaller screens, each with its own graphics characteristics. The number of points

on the screen that can be individually controlled is far greater than on any other small computer. And each point may be assigned one of 128 possible hues, resulting in tremendous possibilities for special effects.

Atari's Space Raiders demonstrates the capabilities of Atari graphics. Game fanatics, and I am among them, say that Raiders' graphics put you in the cockpit of your own spacecraft so convincingly that you actually feel you're in three-dimensional space. If you aren't adroit in using the controls, the enemy will get you in a magnificent display of pyrotechnics. (Remember, Atari invented the video game with Pong; they also gave us Asteroids, Missile Command, and over 400 other arcade games.)

Sound Capabilities

Atari BASIC software designers convincingly blend sight with sound, something not easily done with many other small computers. Sounds range from a particularly nasty crunching noise for a man-eating monster to the dulcet strains of a baroque string quartet. The marriage of sight and sound offers particularly exciting possibilities for education.

Hook-up Capabilities

Business software for the Atari is not easy to come by—there's a word-



At a Glance

Name: Atari 800

Use

Personal computing in homes, schools, small businesses; games

Manufacturer

Atari, Inc.
1265 Borregas Ave.
Sunnyvale CA 94086
(408) 745-2213

Standard Features

6502 microprocessor, typewriter-style keyboard, four independent sound synthesizers, cassette interface, serial interface, four inputs for game controllers or light pens, high-resolution color-graphics capability, 16 K bytes of RAM, outputs for color television and color video monitor, 10 K-byte operating system in on-board ROM, 8 K-byte BASIC ROM cartridge, power supply, and AC line cord

Price

\$1080 to \$1480 (16 K to 48 K bytes of RAM)

Typical System Price

\$1780 for single-disk system with 32 K bytes of RAM

Popular Accessories

16 K-byte plug-in RAM cartridges, 5¼-inch floppy-disk drives, printer, acoustic modem, light pen, joystick, and paddle-game controllers

Other Available Languages

Microsoft BASIC, assembler-editor, PILOT

processing program and, of course, VisiCalc for accounting and financial planning, but there is neither an accounting package nor an inventory-control program. Surprisingly, the lack of business software is not a barrier to

using the Atari for business applications. The secret is the Atari's communication capabilities.

With an Atari and a telephone adapter, called a modem, you can access a large computer system or a second Atari computer across town. I use my Atari as an intelligent terminal to access timesharing services like Dialcom and Boeing Computer Services. To keep communication costs at a minimum, I enter and edit my data on the Atari before calling up the service. A single command transfers the data from the Atari to a remote computer. And I don't have to sit idly by my terminal while the transfer takes place—it's all done automatically.

On Sunday mornings I use my Atari with CompuServe, a timesharing service for paging through the *Los Angeles Times*. Using the Atari with one of the information services, you can send electronic mail, communicate with a large computer, or carry on a conversation with other computer users around the country. In short, the Atari has everything you'll need to make such communications convenient and cost-effective (the modem is not included—you'll have to buy that separately).

What's Inside?

When you get your Atari, you'll probably be unpacking several boxes.

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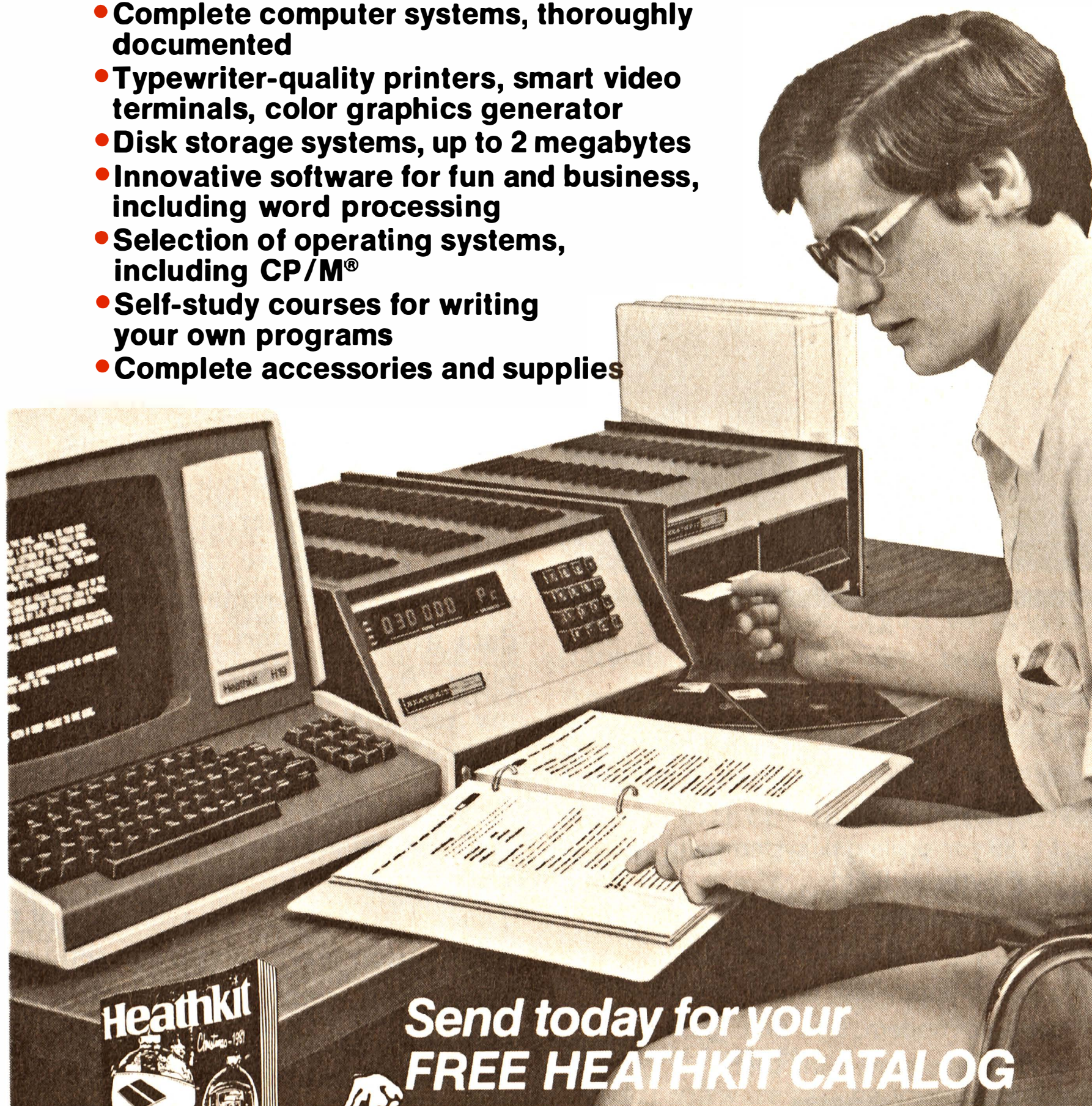
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The first will contain the computer console, an RF signal generator used for connecting the Atari to your home TV, and a power supply which plugs into a 120-volt AC outlet. A second box contains the Atari 410 (\$90), a cassette recorder you'll need to play Space Invaders. You may also be unpacking a video monitor, like the Amdek Video-100 (\$179) made by Hitachi. The Atari 800 has outputs for a video monitor or a color television. I prefer a video monitor when using VisiCalc or some other business package, but a color TV is best for music and graphics.

If you've bought the Atari 800, you've probably purchased the Atari 810 disk drive (\$700) as well. Any serious computer user will use a disk drive instead of a slower cassette recorder. If time is more important than money, you should order the 815 dual-disk drive for \$1500. It quickly pays for itself and is superior in quality to the single-drive unit. If you plan to use a telephone modem or a printer (a printer will be essential for word processing), you'll need to buy the Atari 850 interface module (\$220).

In the way of documentation, Atari supplies an owner's manual and a BASIC reference manual, plus separate user and reference manuals for each of the components. If you are serious about creating your own programs, you'll want *Atari BASIC* (by Bob L. Albrecht et al. John Wiley & Sons, 1979).

The Atari 800 has a big future in personal computing. It outshines all the other major competitors in the key areas of graphics and sound capability and it's one of the least expensive models in its basic configuration. It is not as well supported by outside software and hardware suppliers as the Apple II or TRS-80, but that could change now that Atari's parent company, Warner Communications, has put muscle behind the marketing effort. If you haven't seen a demonstration, you're in for a dazzling surprise. □

Kathy Neale is the publisher of the Physician's Desk-top Computer Letter. She writes reviews and comparisons of small-computer systems.

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Computer Othello

Intense strategy and a better-than-real-life opponent characterize this winning game.

by Rachael Wrege

I played it on the subway, caressed it in the dentist's office, sneaked it under the covers. It started minutes after arriving in the mail. Four "C" batteries in the back, flip the switch, and the entire editorial staff of a magazine was captivated. Suddenly I had more friends than I wanted, all whining and begging for five minutes alone with my Computer Othello.

Addicted, I became stingy and took the handsome, sleek, black machine home for the weekend. It was pure indulgence. A deceptively simple-seeming game, Computer Othello combines the best of backgammon, checkers, and chess, beats the heck out of gin rummy, and kept me happily at home on a Saturday night.

A 64-position, liquid-crystal display screen projects black and white discs. The object of the game is to outflank your opponent's discs, which flips them over to your color. The player with the most discs at the end of the game wins.

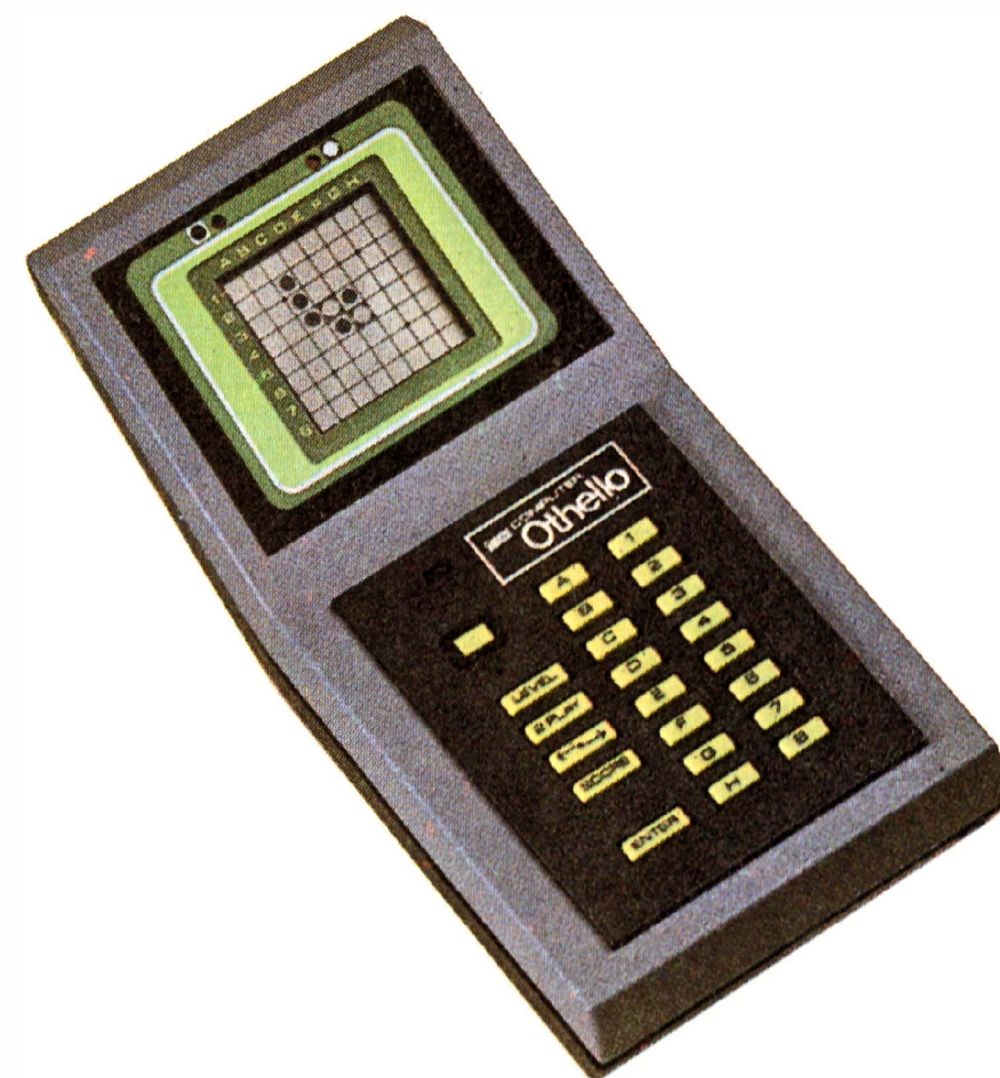
Although two players can challenge one another on Computer Othello (there's a board game for two as well), I found it far more fun to play against the computer. Gabriel Industries, creator of the little marvel, claims the computerized game can "study over 100 tactical moves per second," and

frankly, I don't doubt it. The computer is good, darn good. Eight levels of play are possible against the computer, and each represents an increasingly difficult (and different) strategy. While I thought I'd start at the bottom and work up, I actually found I was better at levels two, seven, and eight.

One interesting feature this computer game has that most "play against the computer" programs don't is a switch that allows you to change places with the computer and either make its next move or have it choose a move for you. It's a fun way to learn the many strategies, improve your game, or just recoup your ego after the computer's run you into the ground a few times.

The game board looks like this:

	A	B	C	D	E	F	G	H
1								
2								
3								
4				●	●			
5				●	●			
6								
7								
8								



Rules of the game are that you must place your disc in a position where it can flip the other player's. You can flip one disc or several in a row, but you cannot skip an empty space or one of your own discs. Discs can outflank in any direction in a continuous line. For example:

A	B	C	D	E	F	G
●	●	●	●	●	●	●

Black disc A was already in position and Black disc G was placed in the last move. White discs B through F will now flip to Black.

Strategy gets more and more intense as the squares fill up with discs, and the game can literally be turned around from a devastating defeat to an exhilarating win during the last few moves. Corners are very valuable, as they can't be outflanked and are permanent endpoints for flipping in three directions. Some Othello fans will tell you that losing two or more corners means a sure loss, but don't believe it. It's just a little harder to squash your opponent.

Now, in case you think I'm a computer-game aficionado who's lost her marbles over this particular one, let

me assure you I'm in good company. Othello has become so popular that a club, the United States Othello Association (USOA), has been created and has dedicated itself to "serving the needs of Othello players and upgrading the quality of play throughout the United States." The USOA sponsors national tournaments and sends the champion to the annual International Othello Tournament. Two years ago, the U.S. champ, Jonathan Cerf, was the first non-Japanese player to win the international title.

The USOA also publishes the "Othello Quarterly," which contains information about upcoming tournaments, game analyses, and strategy tips from the pros. The puzzle below is a sample from the magazine:

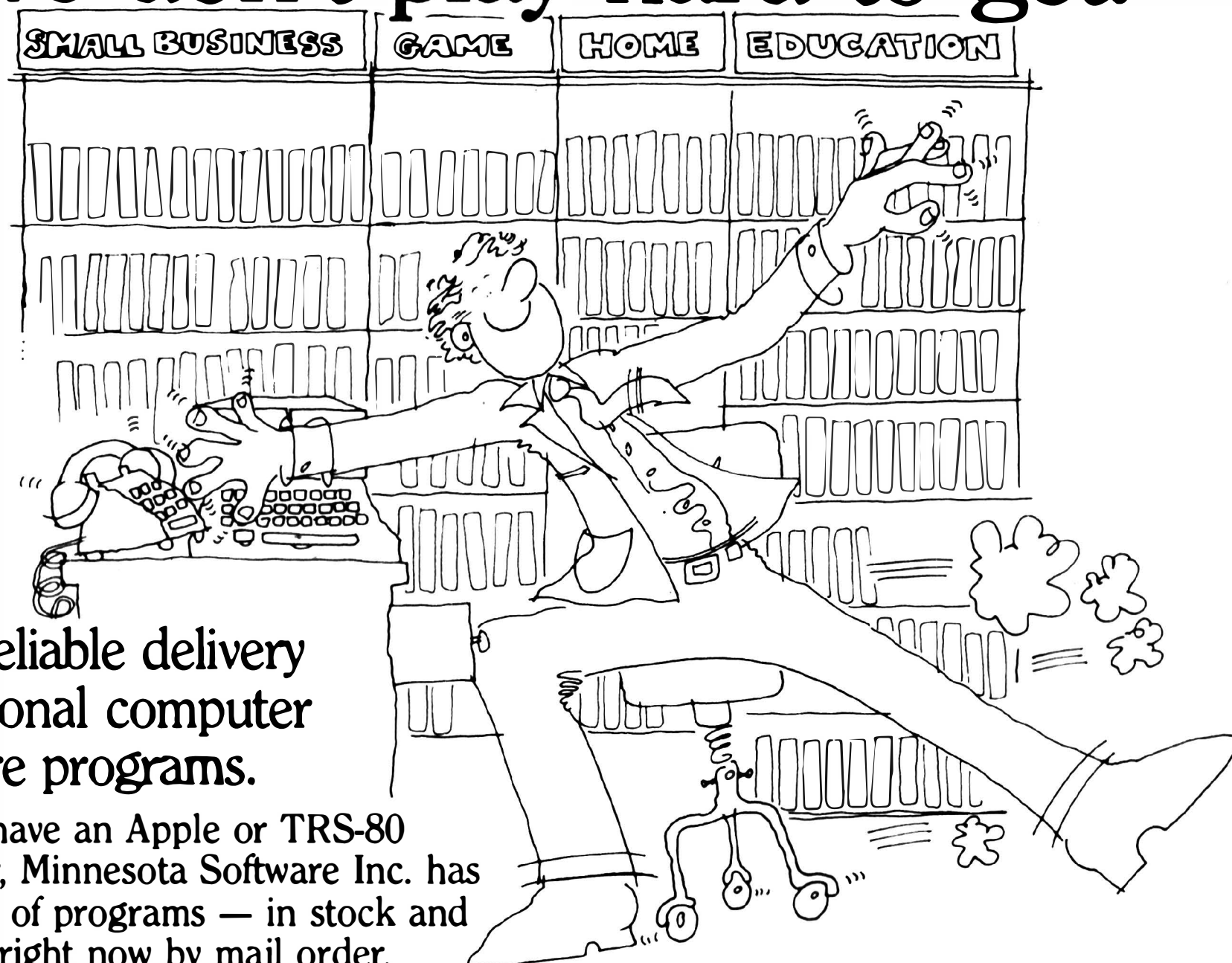
	A	B	C	D	E	F	G	H
1		●	●	●	●	●	●	
2			●	●	○	●		○
3			○	○	○	●	○	○
4	●	○	○	○	○	○	○	○
5	●	●	●	●	○	○	○	○
6	●	●	●	●	○	○	○	○
7	●				●	●		○
8						●	●	

It's White's move, and you have to plot a scheme that allows you to take a corner on your second move. You must deal with any possible defense move from Black so that whatever move Black makes, you can still grab the corner.

Solution: Your first move should be to B2. This way, Black can only go to A2, A3, or B3. Whichever move Black chooses, it will turn over a disc at B2 and thus allow White to take the corner on your second move. (For more information about the USOA, write to the United States Othello Association, POB 342, Falls Church VA 22046.)

Computer Othello also buzzes when an illegal move is made, lights up to tell you whose turn it is, and comes with a 90-day limited warranty. It's almost guaranteed to be oodles of fun on long winter nights. □

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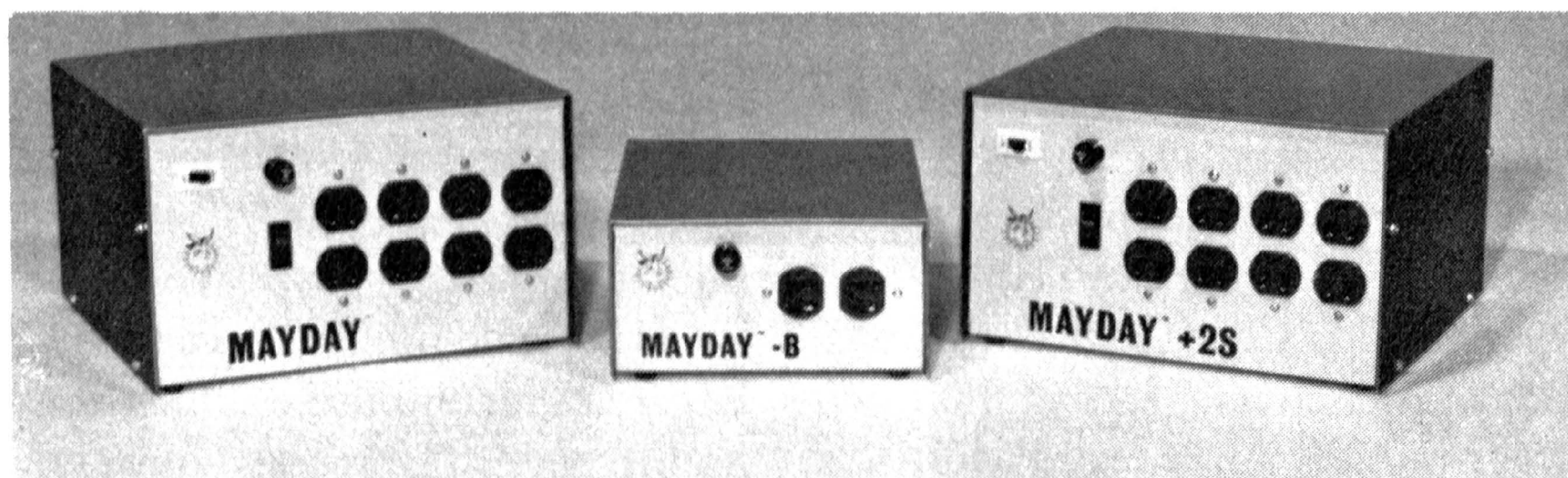
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Practical Limits of Small Computers for Business

by Steve Ditlea

In January 1977, when Radio Shack's Don French demonstrated his prototype of the first TRS-80 computer to company chairman Charles Tandy, its sole applications program was "H & R Shack," simple tax-accounting software cowritten with engineer Steve Leininger. Tandy keyed in his \$130,000 salary and the program crashed due to the limitations of integer BASIC arithmetic. For purposes of the demonstration, Tandy took a simulated \$70,000 cut in pay. Designer French immediately understood the necessity of improving the TRS-80 with floating-point math.

Today, French is head of his own software publishing house, FMG Inc., and he believes that memory-storage capacity in micros is no longer a major limitation. "You can now store millions of characters on hard disks," he explains. Though such technology can be expensive—Radio Shack's recently announced TRS-80 Model II hard disk goes for \$4495—French has staked his firm's future on the development of a dozen microcomputer business-applications programs to be offered exclusively on hard disk.

Constant improvements in memory-storage hardware and systems software, as well as better-written applications programs, have made it difficult to pin down the limits of today's microcom-

puters in business. Not long ago, in an article surveying business-applications programs, I quoted a New York computer-store consultant's remarks about microcomputer limitations. By the time the article appeared in print, the limitations had changed dramatically. One program alone, Stock File, from Softech International of North Vancouver, B.C., had raised the practical limit for inventory control on an Apple II system from 1000 to 9500 items.

Even the barriers between micros and minis are beginning to blur (except in terms of price). Of course, the business user can't expect an under-\$5000 microcomputer system to have the speed or file-handling capacity of a larger minicomputer. On the other hand, several fortunes have already been made by not underestimating the power of the micro. Almost from the beginning, the name of the game in business applications has been the continual upgrading of the microcomputer's inherent capabilities.

According to Andy Czernek of Zenith Data Systems, limits on the number of files a microcomputer can store have actually been set by software choices now virtually standard throughout the microcomputer industry. Microsoft BASIC, the most widely used high-level programming language, can access a maximum of 32,000 different records, while Digital Research's CP/M, the basis of countless

business-applications programs, can address a total of 8 million characters of information on a hard disk. So far, existing business-applications programs are nowhere near to handling such a volume of data.

Keeping Ahead of the Times

IBM's bid for a share of the under-\$5000 business-computer market, its Personal Computer, has increased the feverish pace of improvements in the current generation of micros. Introduced with accounting software from Peachtree Software, this system offers state-of-the-art business capabilities. The accounts-receivable program, for example, can handle up to 150 customer files with 1000 transactions per month on a 5¼-inch disk. (By contrast, IBM's System 23, another recent addition to desktop ranks, features accounts-receivable software capable of tracking 600 customer accounts with up to 5000 invoices per month. It retails for \$9000+.)

Competitive hardware and software suppliers have been keeping abreast of such developments. With Commodore's 8050 disk drive tripling the information capacity of a disk, programs for the company's CBM microcomputers have significantly increased file-handling capacity for the business user. An improved version of the MAGIS accounting system from the Management Accountability Group of Athens,

Georgia, for instance, upped its listing of open invoices in accounts receivable from 6 to 45 per customer and raised the number of customers from 300 to 500.

Even without new hardware, improvements in systems software (the programs that allow the execution of applications software) have extended the practical limits of business micros. When Apple switched its disk operating software from DOS version 3.2 to DOS 3.3, the capacity of a single 5¼-inch disk increased by almost one-third. As a result, the accounts-receivable program for the Apple II by BPI Software of Austin, Texas, upped its capacity from 500 to 700 customers, with up to 1000 monthly transactions.

What's to Come

As programmers become more familiar with the internal workings of existing hardware and software, the

business-applications software they write becomes more efficient and versatile. Pat McAllister, a software-development technician with Commodore, foresees continuing improvements in off-the-shelf applications programs. "Programs written in BASIC are being replaced by software written in machine language," he points out. "It has the advantage of running faster and handling data more easily."

The remaining limitation on business use of microcomputers, as French sees it, is "lack of speed in multiple-user applications. In continuous use with two users, things start to slow down. With four users, they come to a dead stop." But even this barrier may be erased with the introduction of networking plug-in firmware, such as Radio Shack's adoption of the Datapoint-developed ARCNET system for linking together as many as 255 TRS-80 Model II microcomputers.

With every wave of improvement in business capabilities, a greater constituency of potential microcomputer users is created. Businesses that might have found micros lacking in terms of speed and file-handling ability may now consider the very same computers sufficient for their needs. And the knowledge that the practical limits of installed micros will continue to be extended makes upgrading less of a problem.

In any case, constant improvements in performance assure the business user of the value of investing in a micro. What *exactly* are the up-to-the-minute limits? I'd quote an expert, but I'd rather not get anyone into trouble. □

Steve Ditlea is a New York-based freelance writer specializing in personal computers used in small business.

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Beyond VisiCalc

Business Software for Your Personal Computer

by Phillip Good

With personal computers becoming nearly as common in the business setting as electric typewriters, a plentiful supply of creative software has been developed accordingly.

The best example is VisiCalc from Personal Software, Inc. (see Phillip Good's "VisiCalc: An Electronic Worksheet," December 1981 *Popular Computing*, page 34).

VisiCalc offers a row-and-column format for alphabetic or numeric information and allows you to add, subtract, multiply, divide, find partial sums, minimums, maximums, and square roots. Forecasts, bowling-league standings, and tax returns are only a few of VisiCalc's applications.

The great success of VisiCalc has attracted a lot of attention and curiosity about other micro-computer uses for business and home. In this article, I'll survey four additional applications:

Graphic Presentations

Statistics and Forecasting

Information Management

Data Communications

For a few major programs, I'll go into some detail; for others, I'll give a brief description to spark your interest.

Graphic Presentations

For the Apple II. VisiPlot (\$180) is part of the Visi series from Personal Software. It lets you convey the bottom line with pizzazz. Using information you give it directly or taking information from other Visi programs, VisiPlot can generate line charts, bar charts, area charts, scatter charts, pie charts, or combinations of these. It's simple to add labels, legends, and titles, or even change the scale, plot symbols, or color to highlight various parts of the graphic presentation. Like VisiCalc, VisiPlot is easy to master and convenient to use.

The Complete Graphics System (\$60) from Co-op Software lets you create a picture, then rotate, reverse, or duplicate any part of it. You can also choose from a palette of 128 color-patterns, insert text in flow diagrams, and create your own letters and numbers in any size and style. A program like this really helps dress up an otherwise dreary office report.

Higher Graphics II (\$35) from Synergistic Software is an excellent program for creating animated displays. Working with a set of basic shapes, you're instantly an accomplished artist and can compose detailed and impressive drawings.

For scientific applications, there are three essential graphics packages from Interactive Microware—The Scientific Plotter (\$25), Curve Fitter (\$35), and Visichart (\$75). The Scientific Plotter provides some of the basic charts and diagrams of VisiPlot, while Curve Fitter offers many of the same features as

VisiTrend (described later). Visichart gives the scientist the tools for describing and analyzing spectra and chromatograms.

All the graphics programs described above are for the Apple II. Look for comparable entries for other computer models.

Statistics and Forecasting

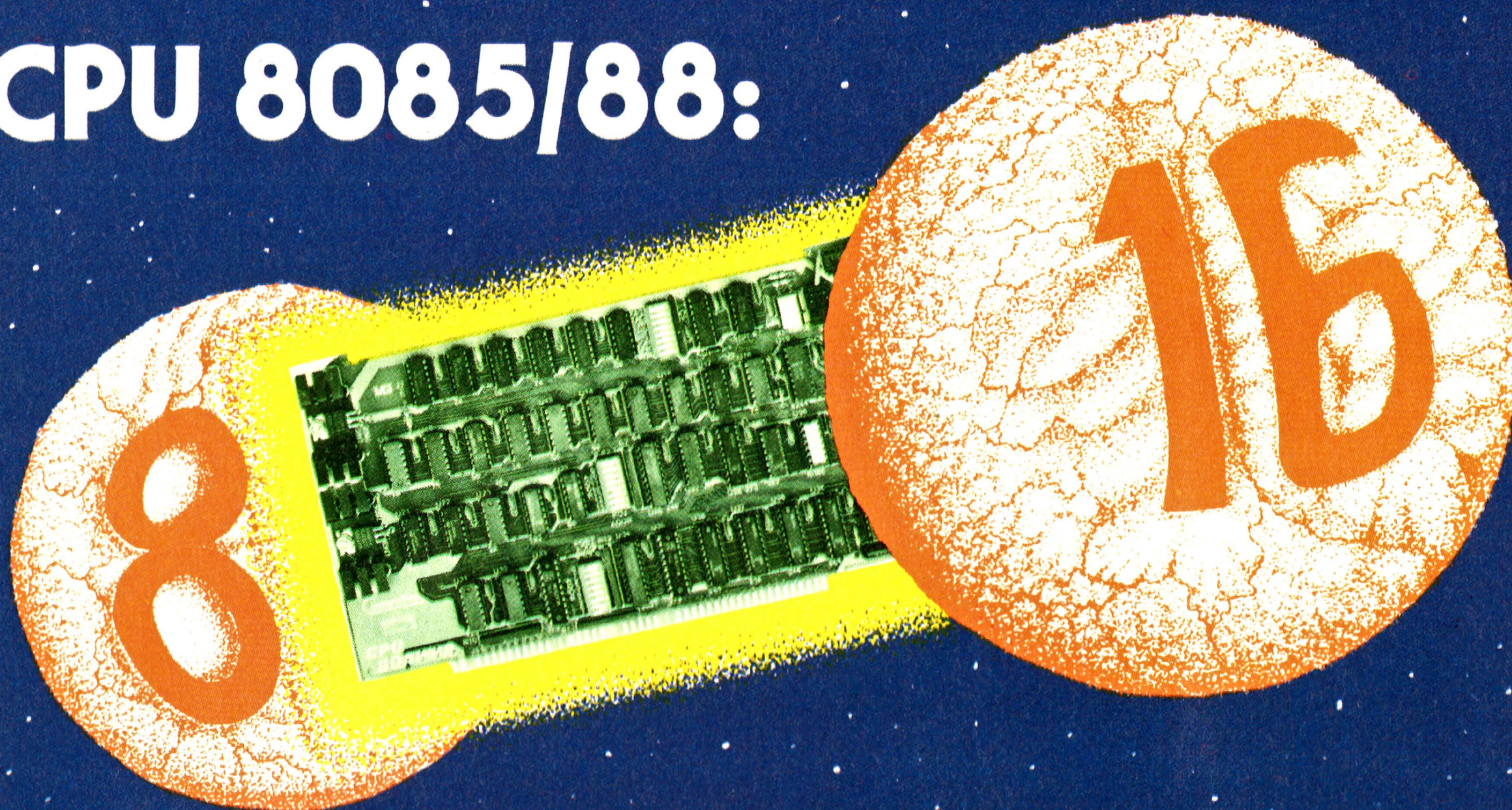
Small computers really shine in forecasting. Several excellent packages exist for a variety of computer models.

For the Apple II. Probably the most impressive of these (at least from the layman's perspective) is the combined package VisiTrend/VisiPlot (\$260) from Personal Software. Using these two programs, it's possible to identify existing trends and forecast future ones. For example, you might want to study the relationships among the daily highs, lows, and averages of stock prices. VisiTrend/VisiPlot lets you spot obvious and not-so-obvious relationships between or among whatever factors you might enter, including volume traded, prime rate, gold prices, Dow Jones averages, etc.

For Other Systems. A broad range of statistical packages for Apple, Atari, TRS-80, and PET computers comes from Dynacomp, Inc. Selections include Regression I (\$19), Regression II (\$19), Multilinear Regression (\$29), and, for analysis of variance, ANOVA (\$19).

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Software Resources, Inc. Trendspotter offers almost every feature of Visi-Plot/VisiTrend (the graphics) and can even load or save VisiCalc files. For the Apple II.

The Statistics Pac (\$ Creative Discount Software for TRS-80 Models I and III or Apple II. The Statistics Pac contains its own database system and programs for curve-fitting, probability, and general statistics.

For CP/M-based computers, Microstat and Statpak offer almost as many functions as do packages designed for mainframe computers. Microstat (\$ from Ecosoft, the brainchild of a Butler University business professor, includes a comprehensive trend-forecasting package, one- and two-way analysis of variance, type I regression analysis, and many nonparametric tests. Statpak (\$500)

has an excellent file management system that allows you to select subsets or merge several sets of data. Numerous single-variable statistics, distributions, and probability calculations are included. Statpak offers essentially the same two sample comparisons as Microstat but has no provision for trend line forecasting.

Information Management

For the Apple II. VisiDex (\$ Personal Software helps organize information. For example, a real estate agent could update listings with VisiDex, and a manufacturer could use the program to keep a closer eye on materials and suppliers. Tapping VisiDex's calendar option, a life insurance agent could easily record information on current clients and maintain a calendar of when to call on prospective ones. The same goes for dentists, physicians, lawyers, and executives.

PFS and PFS Report (\$ Software Publishing Company take less than an hour to master and have all of VisiDex's filing capabilities. Information Master (\$

\$ Information Master has many of VisiCalc's reporting capabilities. It's more flexible automatic formatting. VisiDex patrons may find Data Master's documentation

A Directory of Business Software Products and Suppliers

GRAPHIC PRESENTATION

Personal Software	1330 Bordeaux Dr. Sunnyvale CA 94086 (408) 745-7841	VisiPlot \$180	Apple II
Co-op Software	PO Box 432 West Chicago IL 60185 (312) 231-0912	The Complete Graphics System \$60	Apple II
Synergistic Software	5221 120th Ave, SE Bellevue WA 98006 (206) 226-3216	Higher Graphics II \$35	Apple II
Interactive Microware	PO Box 771 State College PA 16801 (814) 238-8294	scientific graphics programs \$25-75	Apple II

STATISTICS AND FORECASTING

Personal Software	1330 Bordeaux Dr. Sunnyvale CA 94086 (408) 745-7841	VisiTrend/VisiPlot \$260	Apple II
Dynacomp, Inc.	1427 Monroe Avenue Rochester NY 14618 (716) 586-7579	statistical packages \$19-\$29	Atari, Apple, PET, TRS-80
Software Resources, Inc.	44 Brattle St. Cambridge MA 02138 (617) 491-6396	Trendspotter \$275	Apple II
Creative Discount Software	256 S Robertson, Suite 2156 Beverly Hills CA 90211	The Statistics Pac \$100	Apple II, TRS-80 Models I and III
Radio Shack	Fort Worth TX 76102 (817) 390-3011	Advanced Statistical Analysis (Cat #26-1705) \$40	TRS-80 Models I and III
Ecosoft	PO Box 68602 Indianapolis IN 46268 (317) 253-6828	Microstat \$250	CP/M-based systems
Northwest Analytical, Inc.	PO Box 14430 Portland OR 97214 (503) 238-9760	Statpak \$500	CP/M-based systems

INFORMATION MANAGEMENT

Software Publishing Company	PO Box 50575 Palo Alto CA 94303	PFS and PFS Report \$99 each	Apple II
Stoneware	1930 Fourth Street San Rafael CA 94901 (415) 454-6500	DB Master \$189	Apple II

High Technology, Inc.	PO Box 14665 8001 N Classen Blvd Oklahoma City OK 73113	Information Master \$150 Data Master \$100	Apple II
Hayden Publications	Rochelle Park NJ 07662 (800) 631-0856	Data Manager \$50	Apple II
Micro Data Base Systems, Inc.	PO Box 248 LaFayette IN 47902 (317) 448-1616	MDBS \$900-\$1800	CP/M-based systems
Ashton-Tate	3600 Wilshire Blvd Suite 1510 Los Angeles CA 90010 (213) 666-4409	dBase II \$700	CP/M-based systems
Hardhat Software	Box 14815 San Francisco CA 94114 (415) 621-2106	Whatsit? \$129	CP/M-based systems

DATA COMMUNICATION

Southwestern Data Systems	PO Box 582 Santee CA 92071 (714) 562-3670	ASCII Express II \$65	Apple II
Southwestern Data Systems	PO Box 582 Santee CA 92071 (714) 562-3670	Z-Term \$100	Apple II with Z-80 SoftCard
Dynacomp, Inc.	1427 Monroe Avenue Rochester NY 14618 (716) 586-7579	The Communicator \$50	Atari
Atari, Inc.	1196 Borregas Ave Sunnyvale CA 94086 (408) 745-5227	Telelink I \$25	Atari
TNW	3351 Hancock St San Diego CA 92110 (714) 225-1040	XPterm \$59	PET
Radio Shack	Fort Worth, TX 76102 (817) 390-3011	BiSync Communications \$995	TRS-80 Model II
Dynamic Micro-processor Assoc.	545 Fifth Ave New York NY 10017	ASCOM \$99	CP/M-based systems
Hawkeye Grafix	23914 Mobile Canoga Park CA 91307 (213) 348-7909	Commx \$250	CP/M-based systems
Information Engineering	98 Main St Newmarket NH 03857 (603) 659-5891	IE/Modem \$300	CP/M-based systems

stern and forbidding since it is aimed at the computer buff rather than the average user.

DB Master (\$) a sophisticated data management system with user-friendly documentation. Data Manager (\$) publications is equipped to set up a personal filing system or a subscription mailing list.

For CP/M-based systems. Among the best data management offerings is the incredibly comprehensive MDBS, which equals mainframe computer data management systems costing 50 times as much. The basic system is \$900; with all enhancements, including a data recording system, a recovery transaction logger, and an ad hoc query report system, the price doubles. MDBS is a product of Micro Data Base Systems, Inc.

dBase II (\$700) tures a command language which is well suited for developing and using complex data bases. Whatsit? (\$) from Hardhat Software is another easy-to-use filing system in which you define relationships between items as you enter data. (Its name is an acronym for "Wow! How'd they get All That Stuff In There?")

Data Communication

You don't need to own a large computer to take advantage of one's capabilities. All you need is a telephone, a modem, a serial interface, and a suitable data communications program. As the number of commercial "information utilities" grows, so does the number of personal computer programs that take advantage of these services.

For the Apple II. Personal Software's VisiTerm (\$) With it you can talk to any other computer—the one at work or a computer information service such as The Source or CompuServe. You can even exchange programs and information with other microcomputer owners via telephone lines. VisiTerm solves many of the typical communications problems, for instance:

- getting the computer's attention. VisiTerm lets you store the sign-on dialog in advance and then sends it

to the mainframe computer automatically.

- providing password protection. When you type in your password to the mainframe computer, it won't be displayed on your screen for all the world to see.

- making data easy to read. Develop your own display typefaces and set the line length, spacing, and scroll rate. You can even set horizontal tabs (great for tables).

- cutting costs. With VisiTerm you communicate up to 120 characters per second; 30 is the maximum speed of many data communication programs. You can transmit prepared files, not just information typed in while you're on-line. This feature alone significantly reduces the time and money involved.

Also for the Apple II. ASCII Express II (\$65) from Southwestern Data Systems offers file transfer plus almost all of VisiTerm's most desirable features. If your Apple II has the Z80 Softcard, you can run Z-Term (\$100), also from

Southwestern Data Systems. Compared with most other data communication programs, it has a larger buffer (36,000 characters) for temporary storage of data and permits greater control of data in that buffer. It also adapts to many more peripheral communication devices than either VisiTerm or ASCII Express. Z-Term will even let your Apple emulate a DEC (Digital Equipment Corporation) terminal.

For Atari 400 and 800. The Communicator (\$50) from Dynacomp, Inc. allows you to prepare data files off-line, then send them at high speed, without need of slow keyboard intervention. The program's file-receiving facility has some problems, however. Telelink I (\$25) is a limited terminal program from Atari. It does not have file-transfer capability.

For the TRS-80. BiSync Communications (\$995), available from Radio Shack, gives the Model II full IBM 3270/3280 compatibility and lets it function as a remote job entry terminal, entering up to 19,600 bits per

second. The Model II operating system also includes a versatile terminal and file transfer program.

For Models I and III, Communications Package (\$40) is available from Radio Shack, allowing terminal operation and transfer of text and binary program files.

For BASIC terminal operation with information utilities such as Compu-Serve, Radio Shack offers the TRS-80 Videotex program (\$30); versions are available for Models for the Color Computer.

For PET computers, XTERM (\$59) is available from TNW.

For CP/M-based computers, ASCOM (\$99) from Dynamic Microprocessor Associates enables computers to send and receive data files. Commx (\$250) from Hawkeye Grafix allows you to transmit files and use the file control features of CP/M. However, the documentation is poor in form and content.

Phillip Good is a consultant to major corporations on the use of personal computers.

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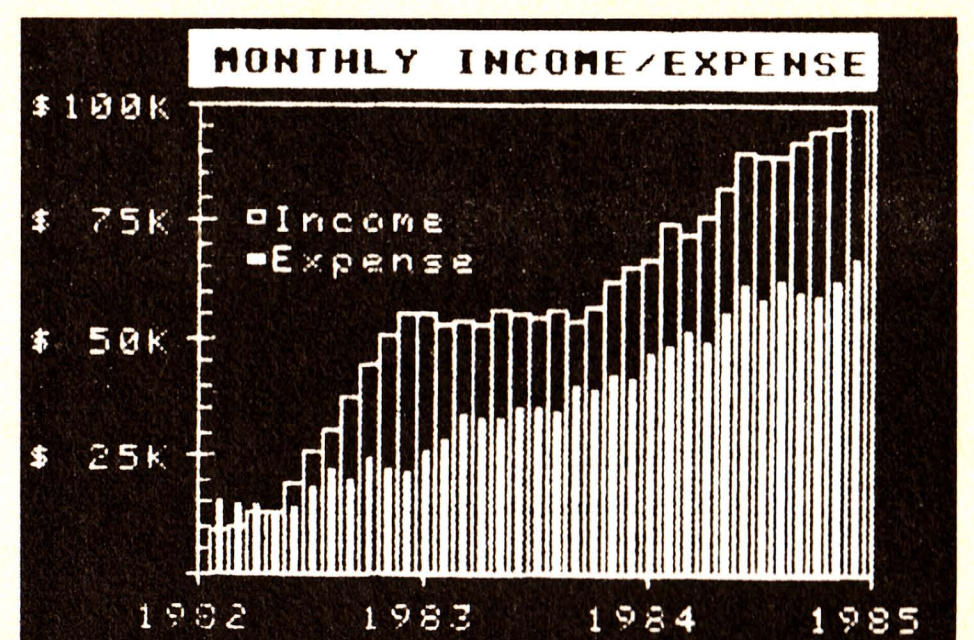
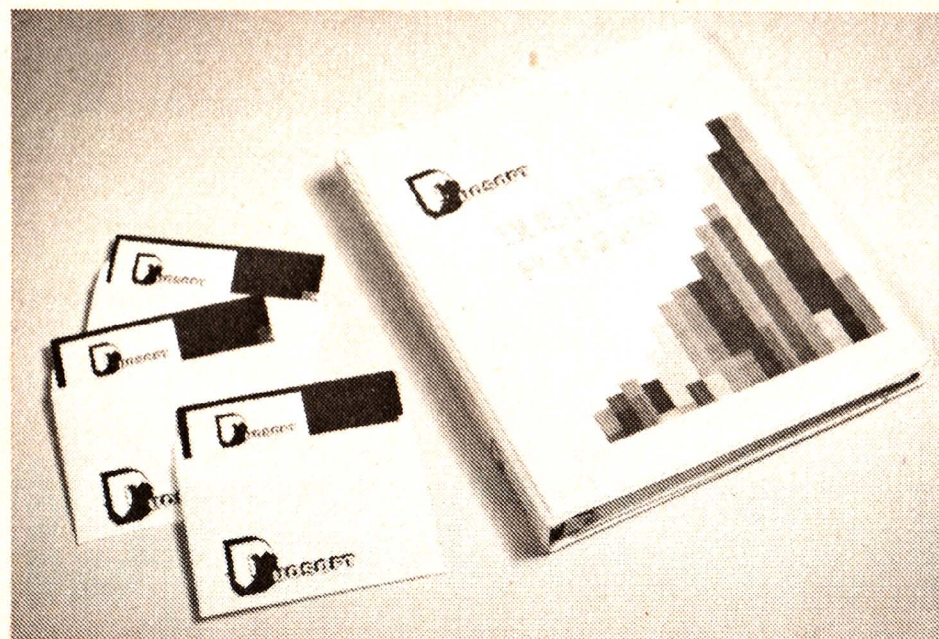


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TOTAL LIABILITIES	82694
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Common Stock Issued	300000
Retained Earnings	197327
TOTAL SHAREHOLDERS' EQUITY	497327
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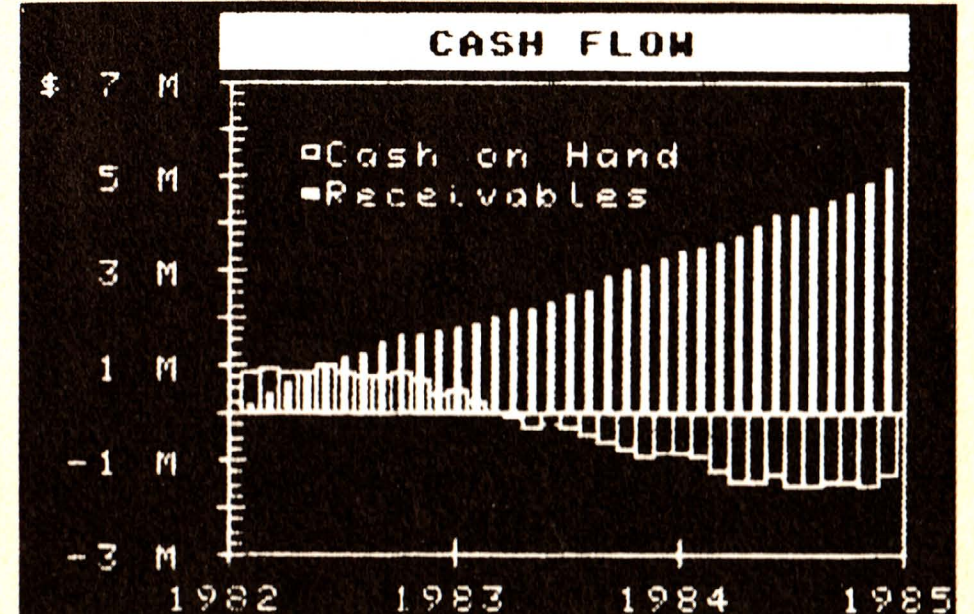
Page 27

COMPANY Word Processing Services, Inc.

MODEL	Medium Growth	STARTING	08/82	ACTUALS	03/83	
ID	Project Name	UNITS	EXPENSE	INCOME	CASH	W/C

MONTH 14 September 1982						
-11	Oper Expense	1 0	"Phone"			
-72	Rental	1 0	"Delivery Van"			
10	General Overhead		2057	0		
-85	Purchase	2 0	"Electric Typewriter"			
-23	Hire	2 0	"Typist II"			
20	Typing Service		4403	5275		
+80	New Product/Service		"Individually Targeted Resumes"			
30	Resume Writing		8472	13205		
40	Printing		23245	36676		
TOTAL			38177	55156	45231	62210

FLOW OF FUNDS REPORT OPTIONS	
A	Inhibit month names
B	Breakdown numbers by project
C	Total monthly expenses/incomes
D	List critical events
E	Subtract income taxes
F	Store financial statement data
G	Show accounts payable/receivable
H	Show all operating expense items
I	Show all income related expenses
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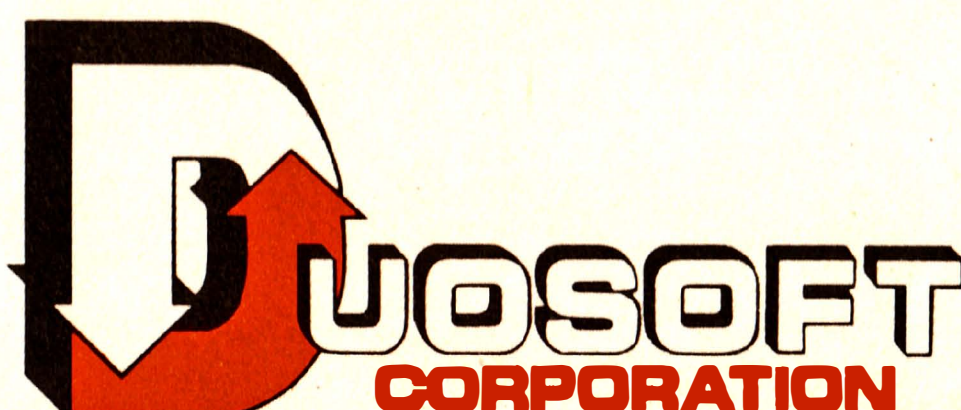
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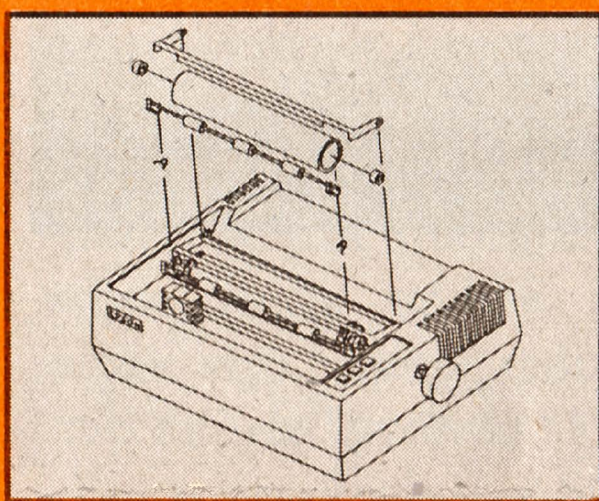
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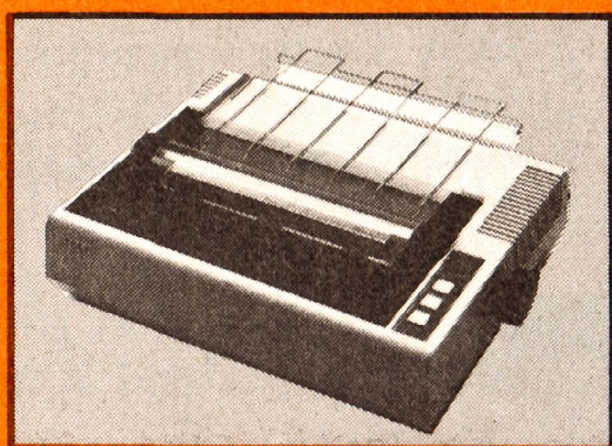
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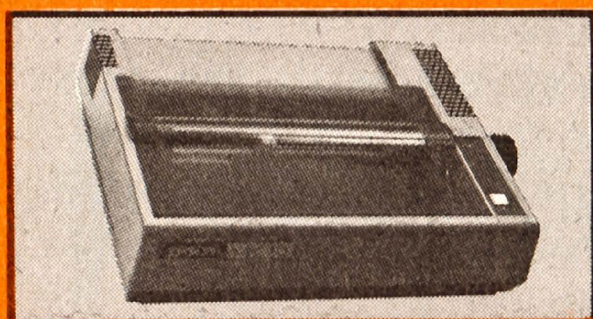
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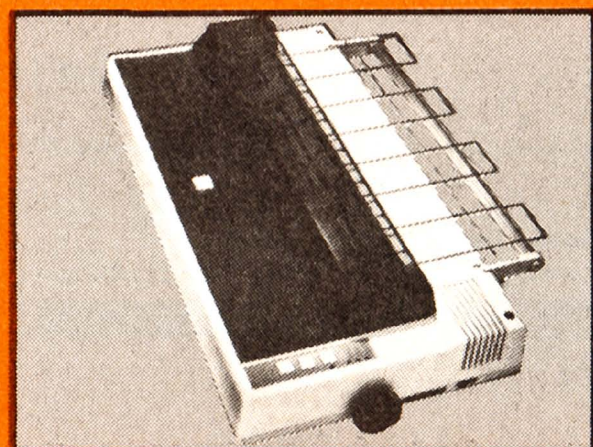
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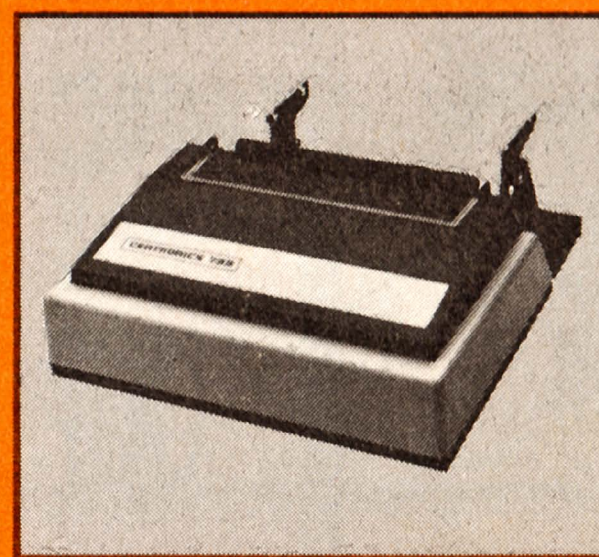
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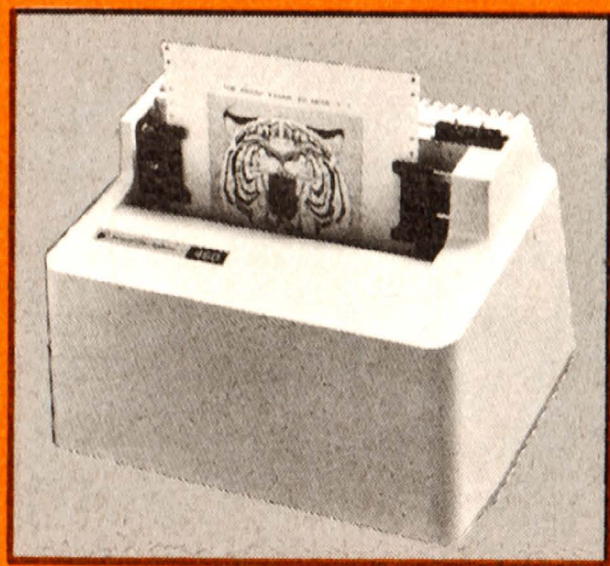
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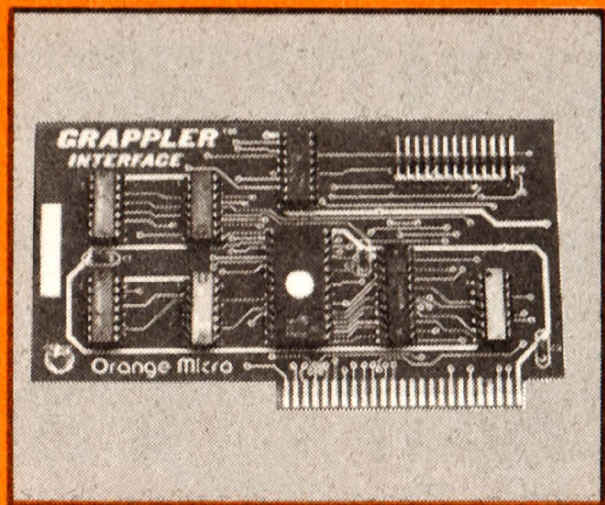
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High (Tech) *Anxiety*

by Rachael Wrege

A cop aims his pistol at the department's computer and blows it to smithereens. A 40-year-old executive drops a month's worth of pencil shavings into his desktop computer, picks up his briefcase, and trundles off in search of a new job. A hospital employee changes critical patient-health data in a computer library. What's going on?

In business offices, college computer labs, banks—almost everywhere they're to be found—computers have created an emotional tension not anticipated by their creators or manufacturers. Otherwise stable people have avoided the electronic children of the technorage as a despised and feared caste, sometimes resorting to outright sabotage.

While few of us get emotionally involved with our Hoovers, our microwaves, or our calculators, many of us feel discombobulated, slightly nervous, or perhaps just uneasy with the humming wunderkinds we increasingly encounter in work environs, homes, and businesses.

Witness the current rash of television ads designed to play on our apprehensive psyches. "We take the anxiety out of computers," says one company ad. "It's a snap. You can do it too!" beams a middle-aged secretary, looking up from her newly installed word processor.

When Silicon Valley and the advertising industry realize computer technology isn't exactly the softest bed the public's ever slipped into, you can bet there's something going on.

Sanford Weinberg calls it "cyberphobia," an extreme anxiety produced by dealing with a high-technology computer system. Weinberg is a professor and administrator at Philadelphia's St. Joseph's College business and information-management department, and has spearheaded research in man/machine communications.

Cyberphobes experience many of the symptoms found in other anxiety-producing situations, including high blood pressure, high pulse rate, and nausea, says Weinberg. When forced to deal with computers, they may be incapable of working and thinking clearly, or their reactions may be less severe but discomforting all the same. Nervousness, unease, stress, or tension—all may signal some degree of cyberphobia.

Who's Affected?

Because it's so new, there are few statistics on cyberphobia, say experts, and no one's really sure just how many people are affected by it. In his Cyberphobia Laboratory Project, Weinberg has worked with more than 500 clients and has seen the phobia cross distinctions of class, race, and sex.

Five years ago, Weinberg discovered manifestations of computer anxiety in college students who balked at or were incapable of producing simple computer projects for communications classes. At least 30 percent of all students exhibited some degree of cyberphobia, he says, with 5 percent of that group reporting extreme anxiety. Alerted, Weinberg turned to the business sector, and in a study of 200 managers changing jobs (although they were considered successful in the ones they were leaving), Weinberg found computer anxiety listed as a chief reason for moving on. "If you look at any



company that computerizes, you'll find there's always a cadre of people who leave and go on to a firm that hasn't computerized yet. But today it's almost impossible to find a company or career without computers in it. Some people are actually changing careers to get away from computers."

Both Weinberg and Ron Anderson, a social psychologist with the University of Minnesota, have found more women affected by cyberphobia than men. One reason may be "math produced by social stereotypes decreeing women less mathematical and logical than their male counterparts.

If Anderson, minority group members are even more hostile. "The vantaged you are, the more likely you will view the computer as a symbol of control," he says. While some lose their computer fears once they understand the limitations of the machines, others never get over their anxieties. "With computers, fear is generated because of social comparison. The expectations are that the computer will demand something of you and, at the same time, that it will outdo you, outperform you. It's against a formidable opponent." When a person decides he or she is incapable of dealing with a computer, he adds, the machine becomes an alienating force and a threat to personal identity.

Hostility toward computers in the workplace is widespread and can result in increased physical ailments linked to stress among office and clerical employees, says MIT researcher Shoshanah Zuboff. Hostility is generated when workers feel they've lost control over job environments and it usually surfaces soon after computerization is implemented. People feel undermined when they realize valued skills and talents can be taken over by the computer. "This situation exacerbates the issues of power and powerlessness found in all levels of organizational life," she notes.

Management professionals may also resent and fear the computer system, Zuboff adds, disliking its structured and abundant data, and preferring more ambiguous information. "The

tainty of limited information (not generated by computers) may lend itself to errors of judgment
vides 'free
spired." This free space is fundamental to the psychology behind professional work.

In creative decision making and the tightening of controls computers may impose, says Weinberg, employees may simply distrust computer accuracy. "I've known accountants who keep a second set of books when using a computer. They have to double-check to feel comfortable," he adds.

Computers can not only create power shifts within an organization, but they may also become scapegoats for existing problems, say researchers. Viewed as half machine/half robot, and somewhat alive, they've become punching bags for the disgruntled employee skipped over for a promotion, the frustrated executive shut out of upper-level meetings, or even for a national sense of anger—one psychologist keeping tabs on computer-sabotage stories reports a startling increase in destructive incidents during the Iranian/American hostage crisis.

Why Computers Are Intimidating

Many people are intimidated by the complexity of computers and the wide range of applications the machines can handle. "It's to people working with them every day," Anderson remarks, speculating that while most people channel their anxiety into healthy competition, others experience only frustration and anger.

Few technologists have gone out of their way to make computers less intimidating and more accessible to the general public, says Weinberg. "It field where to be successful, you had to be esoteric; where the people programming computers had secure, high-level positions because no one else knew how to run the machines. I've talked to people who have gone out of their way to obscure terms or make up new ones when their job pened because they believed if they made it too clear, they wouldn't be needed any more."

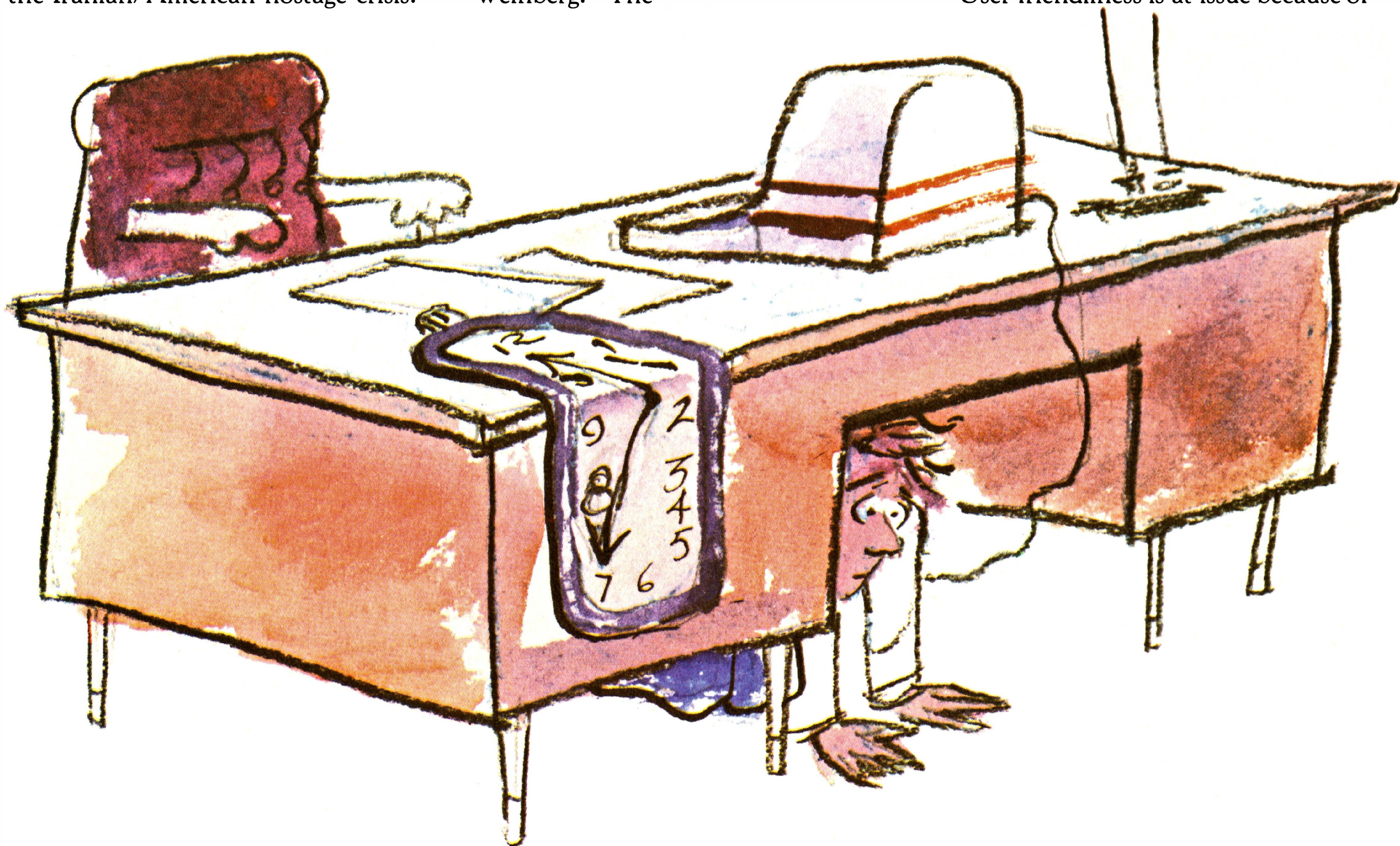
Economic motivation was not the sole factor in attempts to obscure the field—there were psychological aspects as well. "It's Weinberg. "The

the priests and they kept the secret rituals...computers were worshipped...a mythology developed."

Along with the mysteriousness of their engineering, another big factor in cyberphobia is that computers haven't been designed for human use. "People are afraid of breaking the computer and it's designed so that if you do break it, it looks like your fault," he says. "Press wrong button and the screen goes blank, and you're left wondering what you did wrong. Well, if you're driving home and you hit the wrong blinker, should your engine stop? Machines should survive normal use."

Where people resist, however, manufacturers are trying to ease their fears, and Silicon Valley entrepreneurs are now starting to measure their products in terms of "user Weinberg recommends changes in such areas as keyboard labeling and user prompts. "Take ple. You push it when you need help. Why not just label prompts, such as a flashing cursor, are traumatic, Weinberg asserts, and should be tossed out in favor of more calming signals.

User-friendliness is at issue because of



the rapidly expanding home-computer market. "Some into that market also make toys, like Mattel and Atari. They know you can't make toys traumatic or they won't sell," comments Weinberg. Other experts point to marketing approaches by larger personal-computer firms as indicators of new awareness. Names like Apple and PET are "cozy researcher. "Fruit bite."

Market research is currently attacking the problem in the form of new technologies as well, says Melinda Shorr, a Boston-based market analyst and one of Weinberg's former clients.

"Most research is going into things like voice recognition systems that can be used instead of

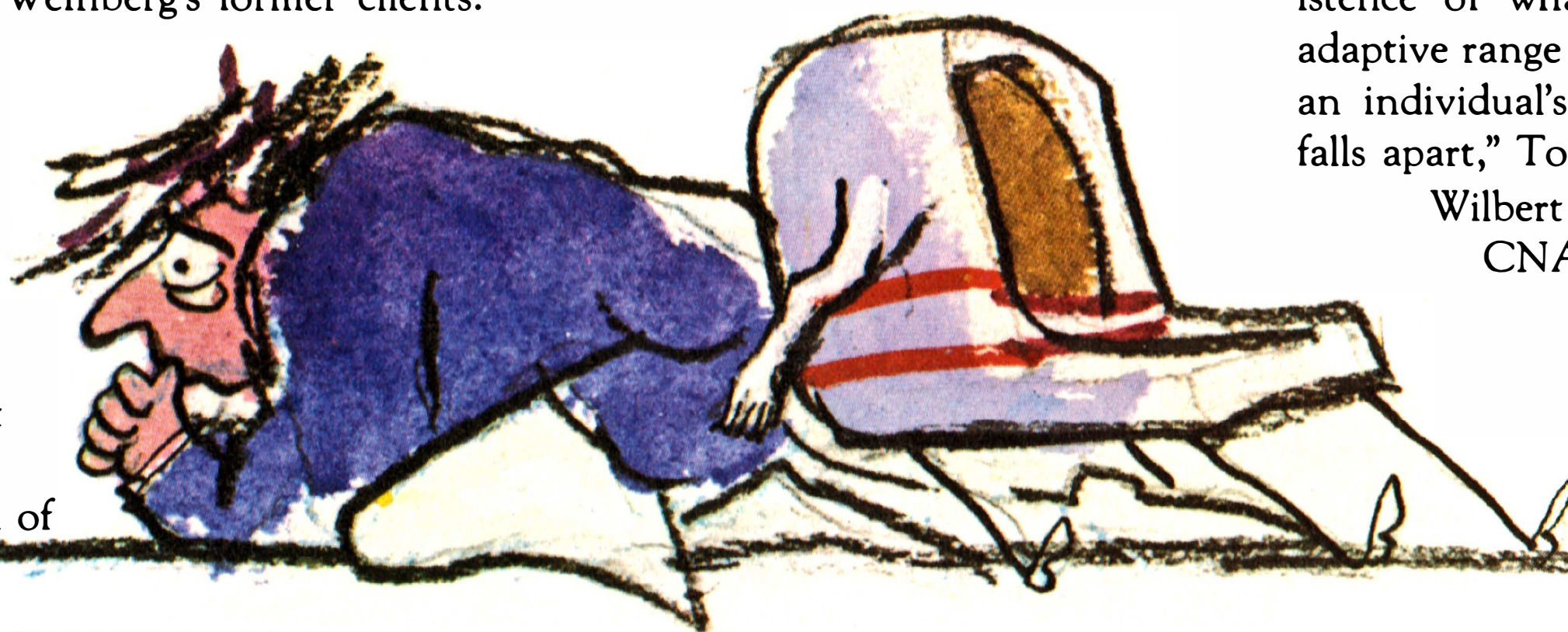
cathode ray tubes (C keyboards. . .it's obvious there's a real problem going on out there, based on the huge amounts of money spent to do something about it."

Underlying the cyberphobia phenomenon may be the fact that we're still the first generation of computer users, says Weinberg, and unfortunately most of us were introduced to the brave new world of electronics through computerized billing. It piest of meetings, Anderson recalls, and the stereotypes created in the 1950s and '60s still hang on. Some of those stereotypes include visions of the com-

puter as the ultimate dehumanizing force, the overwhelming brain trust, and the tyrannical dictator, he says. At the very least, most of us still believe in "computer comes to credit card and other bills.

Cyberphobia as a social phenomenon may boil down to how we deal with change. "Future by author Alvin Toffler in the '70s (in book of the same name) is an anxious response to "overstimulation," ring when individuals cannot adapt quickly enough to change. "Experiments with dogs, deer, mice, and men all point unequivocally to the existence of what might be called an adaptive range below and above which an individual's ability to cope simply falls apart," Toffler writes.

Wilbert Galitz, a consultant for CNA Insurance Speaking at a National Institute for tional Safety and Health conference, Galitz told the



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crowd that resistance to computerization by office workers and low-level management is often caused by executive failure to address the issue of change. Company computerization is least traumatic when timing is right, implementation is slow, and employee roles and positions are clarified in light of the new technology, says Galitz.

Computer Sabotage

Does cyberphobia really merit such attention? In a study of recently computerized government hospitals, Alan

Dowling, an expert in computer systems and the health-care industry, found that 45 percent of all hospitals investigated experienced some incidents of "staff

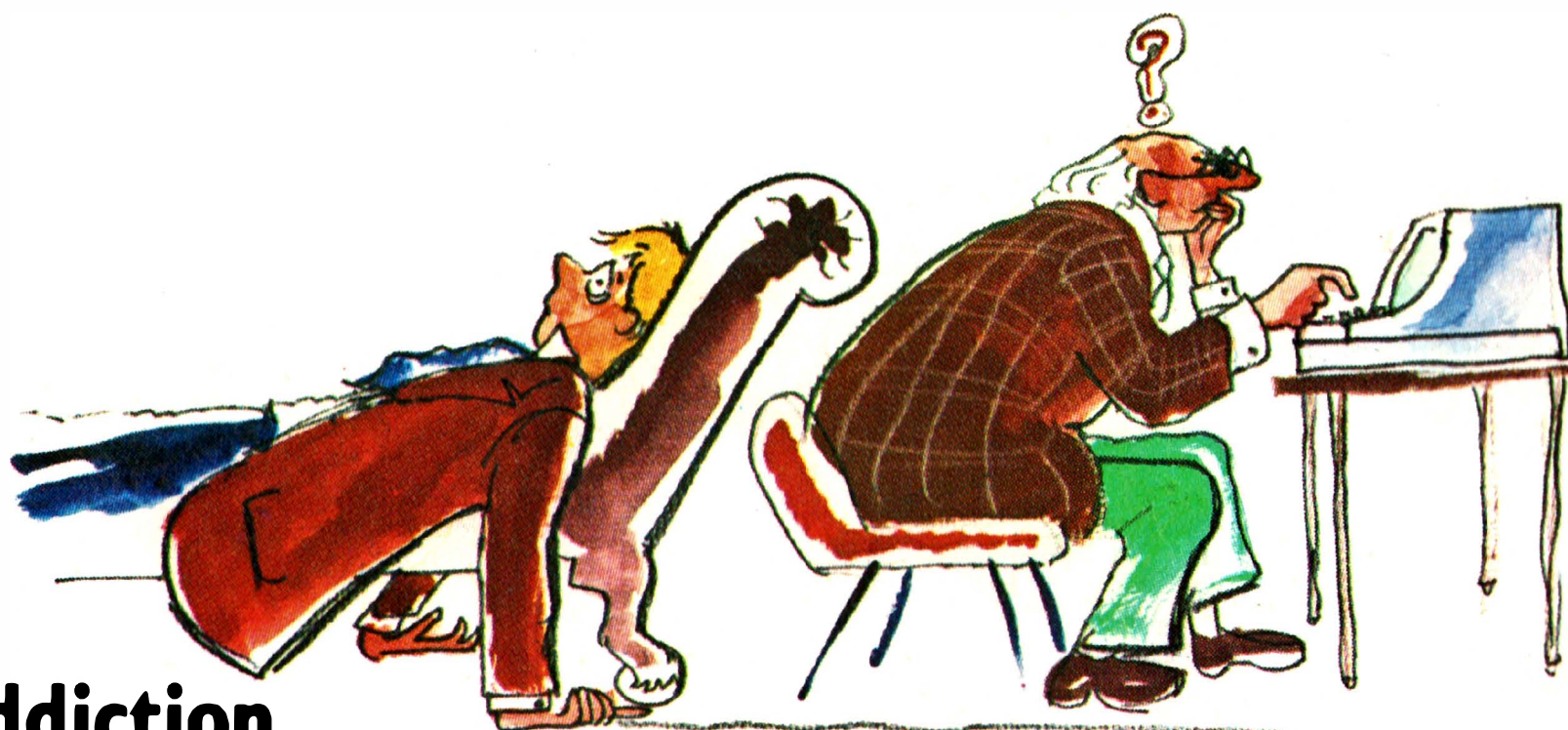
Dowling calls it staff interference, other computer researchers call it out-and-out computer sabotage. It's not rare and the consequences can be devastating.

"Scluded erroneous entries in patient data that could have affected patient care when practitioners made medical deci-

sions based on the information." This kind of sabotage could have "life ening implications," Dowling says. "I'd rather have someone pour a can of Coke into the computer than change patient data."

Staff interference in the hospital study ran the gamut from employees inputting erroneous information to simple refusal to use the system. At one hospital, a 30-year veteran of the nursing staff refused and use the computer. Because of her personal and professional influence, no

Cyberphilia, The Hacker's Addiction



If cyberphobia is an extreme fear of computers, cyberphilia is the flip side of the coin. People with cyberphilia are also known as "hackers," "computer bums," and "electronic junkies," and if reports from computer centers across the country are valid, they're everywhere.

Joseph Weizenbaum, professor of computer science at MIT, calls them "compulsive programmers," and describes them as "bright young men of disheveled appearance. . . their arms tense and waiting to fire their fingers." They program, he says, "until they nearly drop, 20, 30 hours at a time. Their food, if they arrange it, is brought to them; coffee, cokes, sandwiches."

Cyberphiles, says Sanford Weinberg (see main text) are "so involved with computers that they become an end in themselves. They forgot the purpose of computers is to do something and

become much more interested in maintaining system for its own sake. . . they get so wrapped up in it they have no life outside the computer."

Computer-science students and programming professionals are most prone to computer addiction, which reflects their access to large computer systems rather than the psychology behind the phenomenon. At one large training facility, says Weinberg, managers installed a special procedure in the computer system to shut off game playing and "senseless programming routines" during normal work hours. At colleges across the country, computer-science professors have followed suit, strictly controlling computer use during certain hours "or else nothing would get done and no one could use the computers for college assignments," says Weinberg.

The psychology behind "hacking" (as endless programming is termed) is not well researched. But Weizenbaum compares the compulsive programmer to a compulsive gambler, noting that "the computer challenges his power, not his knowledge." The hacker seeks the same type of control that cyberphobes shy away from, playing a role as "the creator of universes for which he alone is the lawgiver. . . programmed scripts compliantly obey their laws and vividly exhibit their obedient behavior. No playwright, no stage director, no emperor, however powerful, has ever exercised such absolute authority to arrange a stage or a field of battle and to command such unswervingly dutiful actors or troops."

Some psychologists speculate that the compulsive programmer is literally escaping from life by creating a world within the computer. Others say hackers can

relate better to computers than people, finding them more stable and predictable.

"It seems to be a different thought process, a comfort with logic and a discomfort with illogic," says Weinberg. "People who tend to be intolerant of illogic in people are going to be more comfortable with computers."

Cyberphiles don't tend to seek help for themselves, because they don't see their compulsion as a problem. "It's kind of counterproductive for them. They may not have a social life but their business life is just fine," says Weinberg. And although some colleges and data-processing businesses have counseled the hackers in their midst to seek help, businesses or computer centers may keep them on simply because no one else understands the system the hacker built.

one on the nursing staff used the computer system.

While some of the computer-sabotage incidents don't create medical problems, they are almost always costly, says Dowling. Systems operators may spend countless hours trying to find "bugs"

problem is erroneous information. Costs are inflated when employees don't use the computer. Money disappears when billing and accounting procedures are monkeyed with. Some hospitals actually removed entire sections of their computer systems because personnel problems were unsolvable.

People have to accept computer systems before they can become operational and this has motivated computer sales departments to change their training procedures. "I

taught employees to operate the systems—now they're bringing in communication specialists," says Weinberg.

Newly computerized firms are also feeling the pinch. Management professionals can be traumatized by comput-

ers because "their of decision making that's noninformation based . . . eventually a manager decides here's someone he can trust, or here's someone he can't, or here's what he thinks is going to happen," says Weinberg. "S

result (of frightening They say, 'OK, if today I let you give me a system that can handle the financial progression of my company, you'll have a program that will replace me a year from now.' The fact is, they may."



Solving the Problem

Not unexpectedly, communication and computer experts like Weinberg, Dowling, and Anderson work as consultants for businesses and industries currently installing computer systems. All stress human engineering, use of existing staff capacities, and management support with training and documentation. "If

user," says Dowling, " ' b d "

Employees must be given time to change, and Dowling counsels his clients to monitor the change process carefully. "I

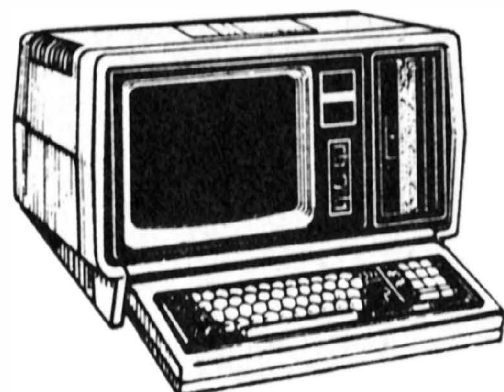
together to resist, you want to know about it ahead of time," he says. This allows upper-level management to gain employee support, solve problems, and gather insights they might otherwise have missed.

He also makes a distinction between employee attitude and behavior. "When

and the attitudes haven't, then you're set up for computer sabotage.

ple may seem to be in sync with the

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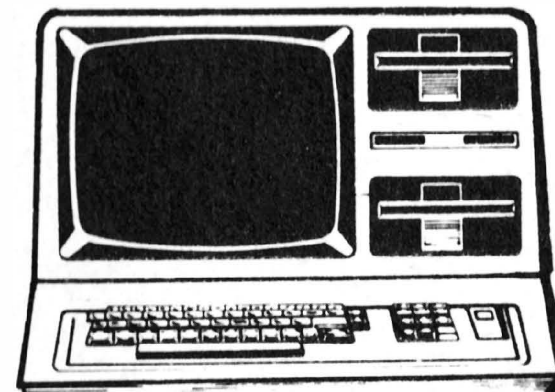
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change, but if their attitudes haven't changed they'll be waiting behind a rock, ready to spring."

Individual cyberphobia include the behavior modification technique used by Weinberg in his Cyberphobia Laboratory Project. Depending on the level of anxiety exhibited by a client, Weinberg starts off with lessons in what computers can and cannot do. He then moves on to simple brain teasers, asking clients to first solve them in their heads, then with a pencil and paper, then a calculator, and so on, through microcomputers, minicomputers, and larger systems. "I

solve the problem and we consistently point out that every machine is a tool, just like the pencil. The overwhelming argument we give to people is that whatever loss of humanism there might be, whatever loss of control, what's really important is how much the computer can do for you."

Some people are solving the problem themselves. Feeling the pinch of computer ignorance in their jobs their own tension in dealing with computers, many professionals are going back to school to bone up on computer literacy. "U

dispensable in business and whatever else is going on, people will have to understand and be able to cope with computers. It's

to use the language, but rather what decision rules should be used. The individual who says, 'No, I don't deal with that—it frightens me, let someone else do it,' will be the person who loses . . . the people with influence and power will be the people who understand how to dictate rules to the computer," Weinberg says.

A Dissolving Problem?

Some researchers speculate that cyberphobia is a generational problem. In

literate kids enter the workplace, computer anxiety will go away like a bad dream. "I acclimated to a new technology," says Dowling. "When have fun with it, problems will be greatly reduced."

Other experts disagree. "E years from now, people won't be working with computers day in and day out. . . . There'll still be a lot of fear," says Anderson. In even be a computer class difference to worry about, he adds, as some school

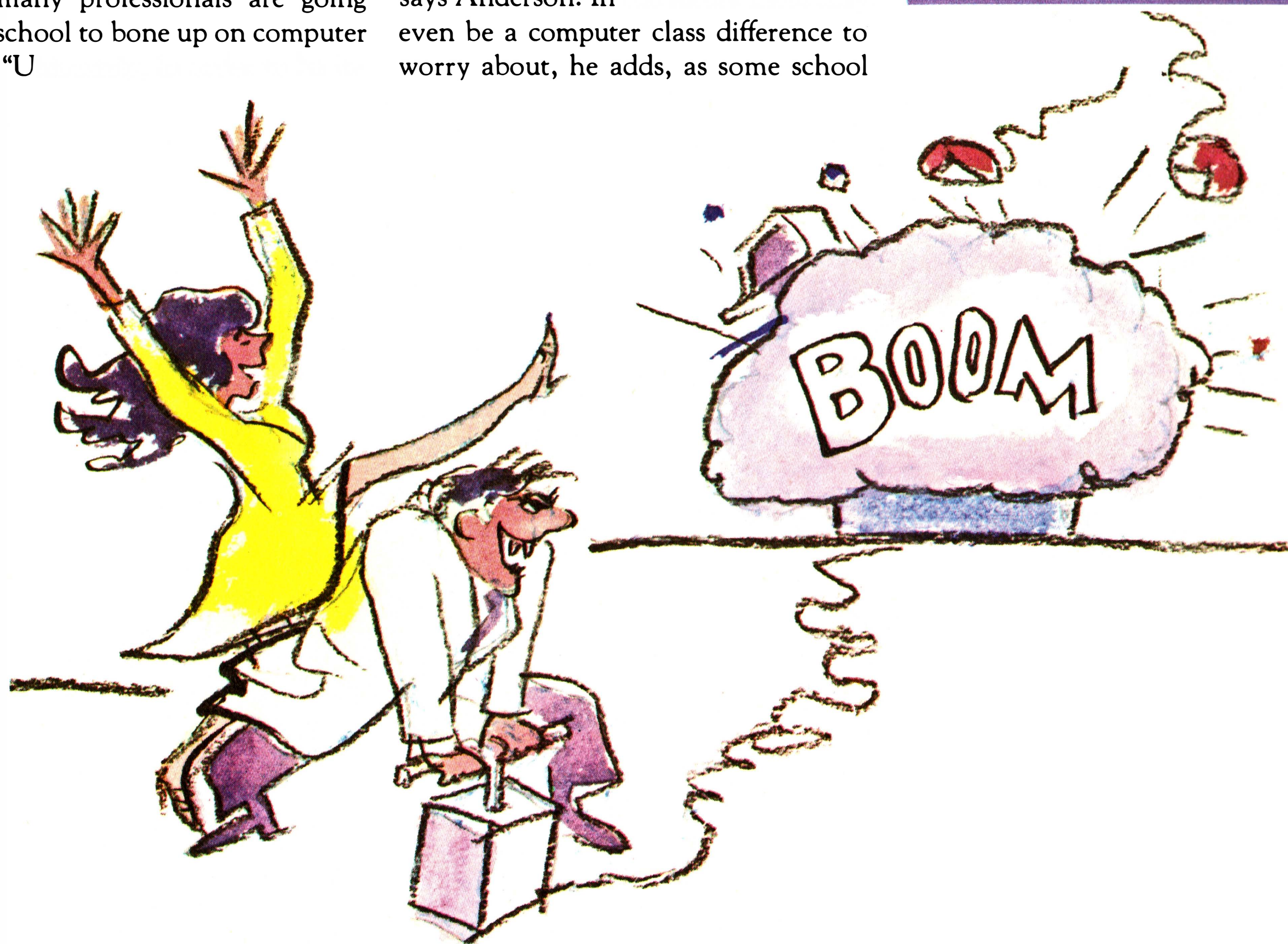
systems teach computer education and others don't.

Dowling's predictions are, perhaps, the most reasonable. Computer fears and anxieties, he says, will be "greatly reduced—although I they'll go away completely because we're dealing with individuals." Certainly, he adds, old-method management will give way to younger executives "for just part of their bag of tricks." But, he insists, anxiety and incidents of sabotage will most likely mushroom before they decrease, simply because more and more people are being forced to deal with computers.

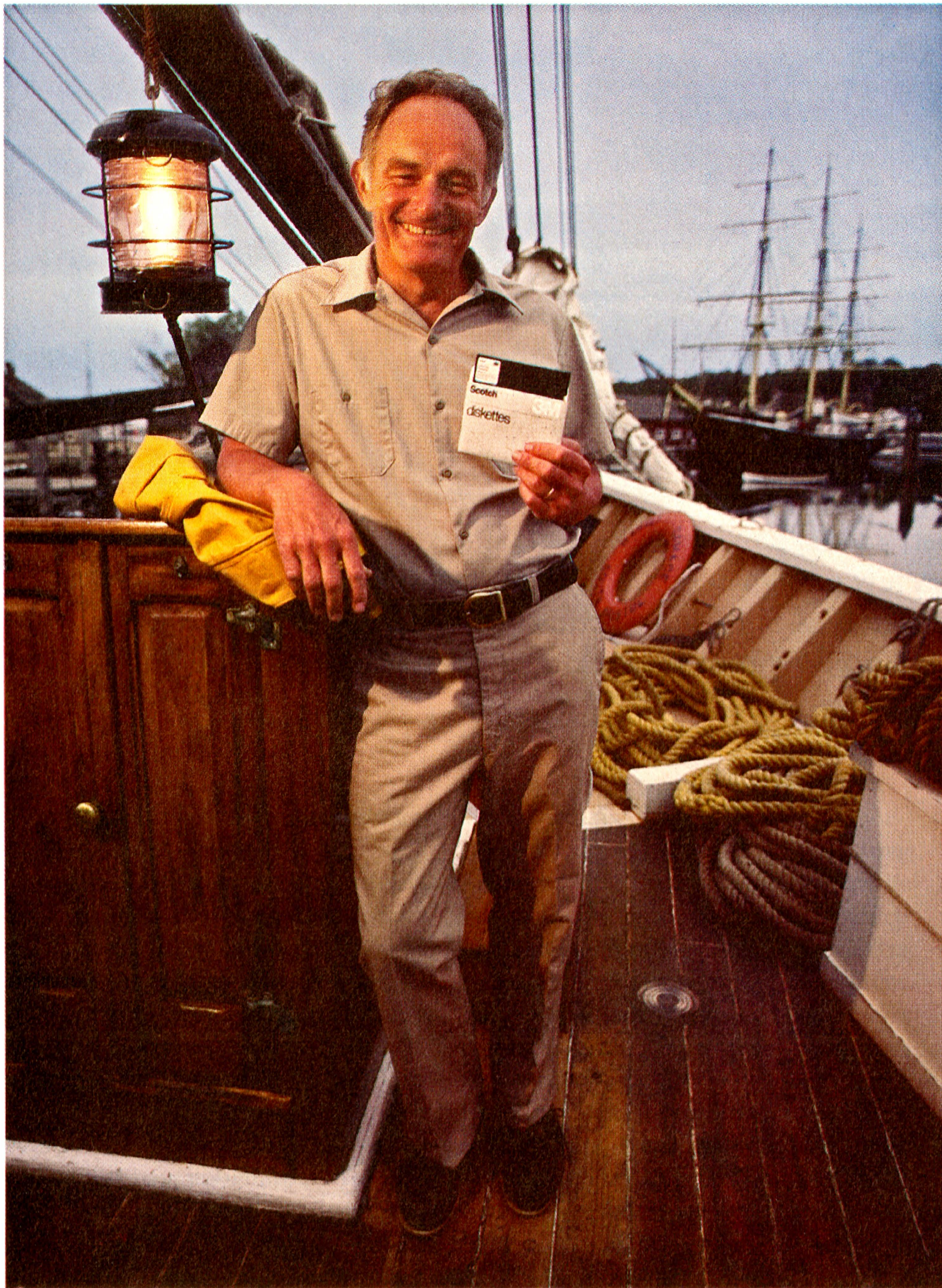
In take computerphobia lightly. Mistakes may be purposeful, your information may be inaccurate, that Coke might not have spilled accidentally, and your "bugs" □

Rachael Wrege is a reporter for Popular Computing.

Illustrations by Austin Stevens



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Chips for the Making

We're in the chips—computer chips, that is.
Here's a look at what they are and how they're made.

They're everywhere! In cars, color television sets, and microwave ovens. They bleep out at you from electronic toys, telephone lines, and automatic tellers at the bank. And they're multiplying. What are they? Called integrated circuits—or computer chips—these tiny bits of silicon have brought computing power out of science labs into everyday life. These minute chips, smaller than your fingernail, have caused a change comparable to, maybe even greater than, the invention of the telephone, airplane, and automobile.



Early Computing

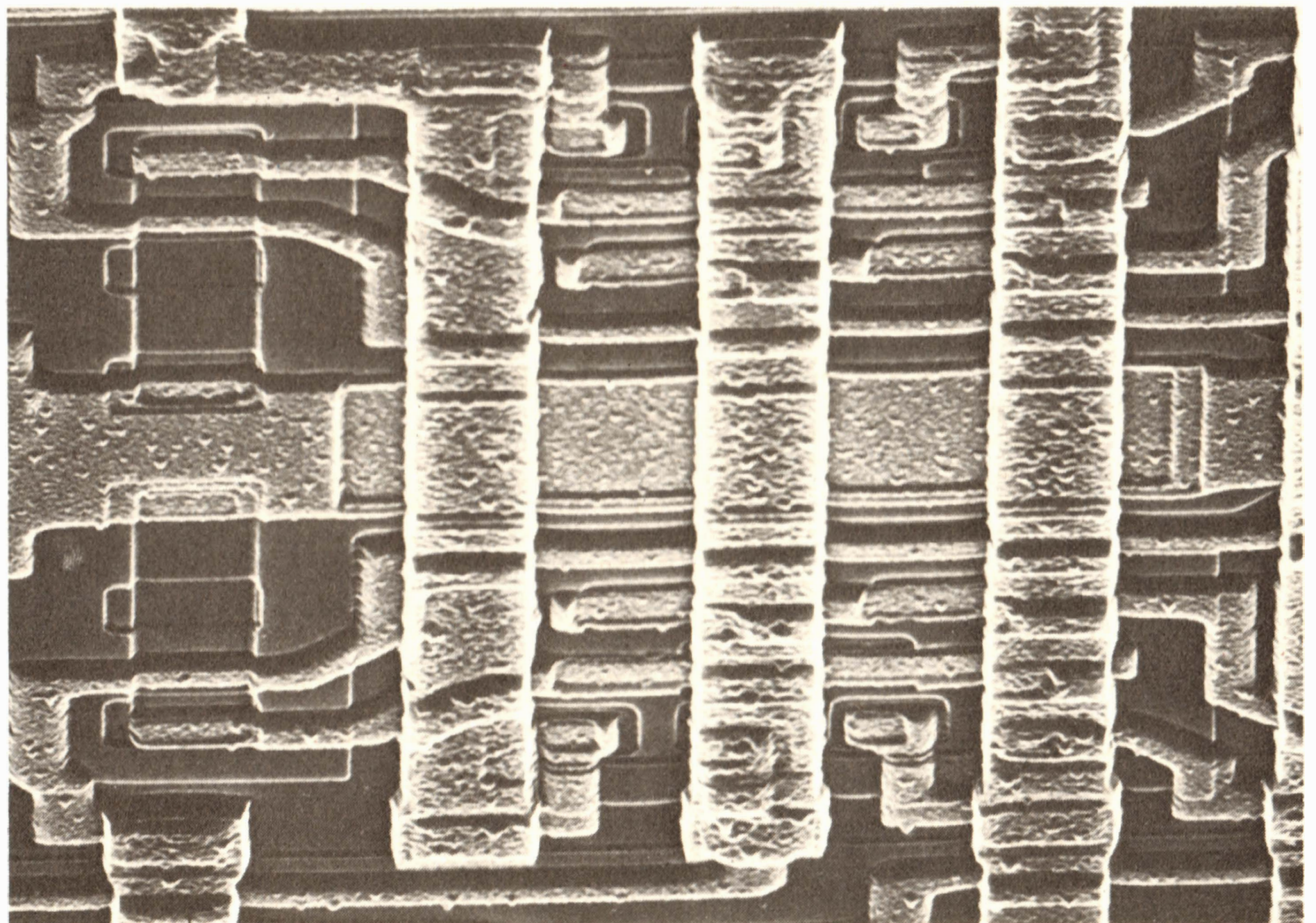
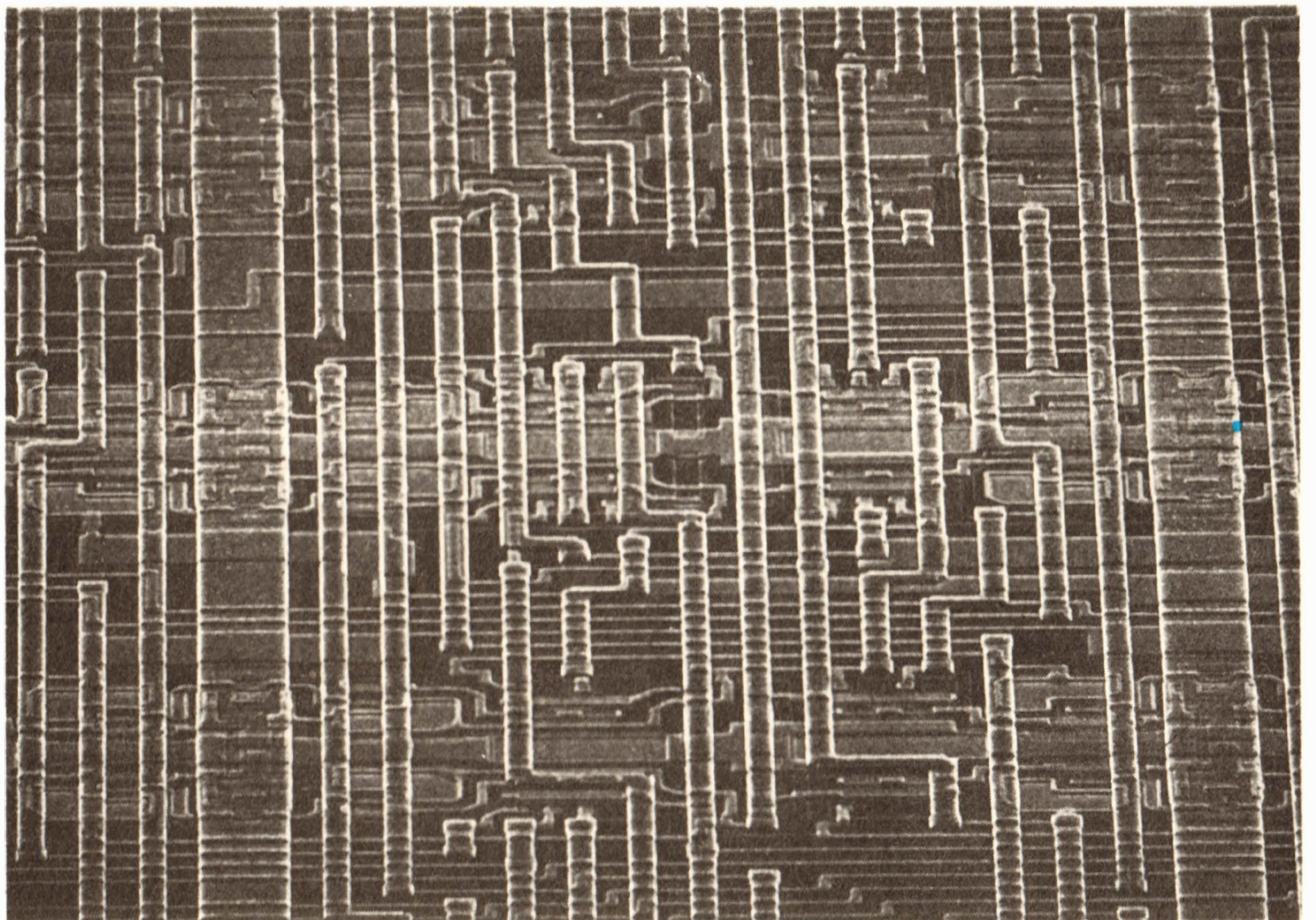
The first general-use computers developed in the early 1940s were massive machines housed in huge buildings with carefully controlled air temperatures and filtering systems. They depended on thousands of vacuum tubes and miles of electrical wiring for their computing abilities. Toward the end of the decade, transistors were developed using semiconductors (substances that allow electricity to flow through them). This development reduced the size of computers. The transistors were wired on to circuit boards, several of which could process binary information when hooked together. In the 1950s these transistors became much smaller.

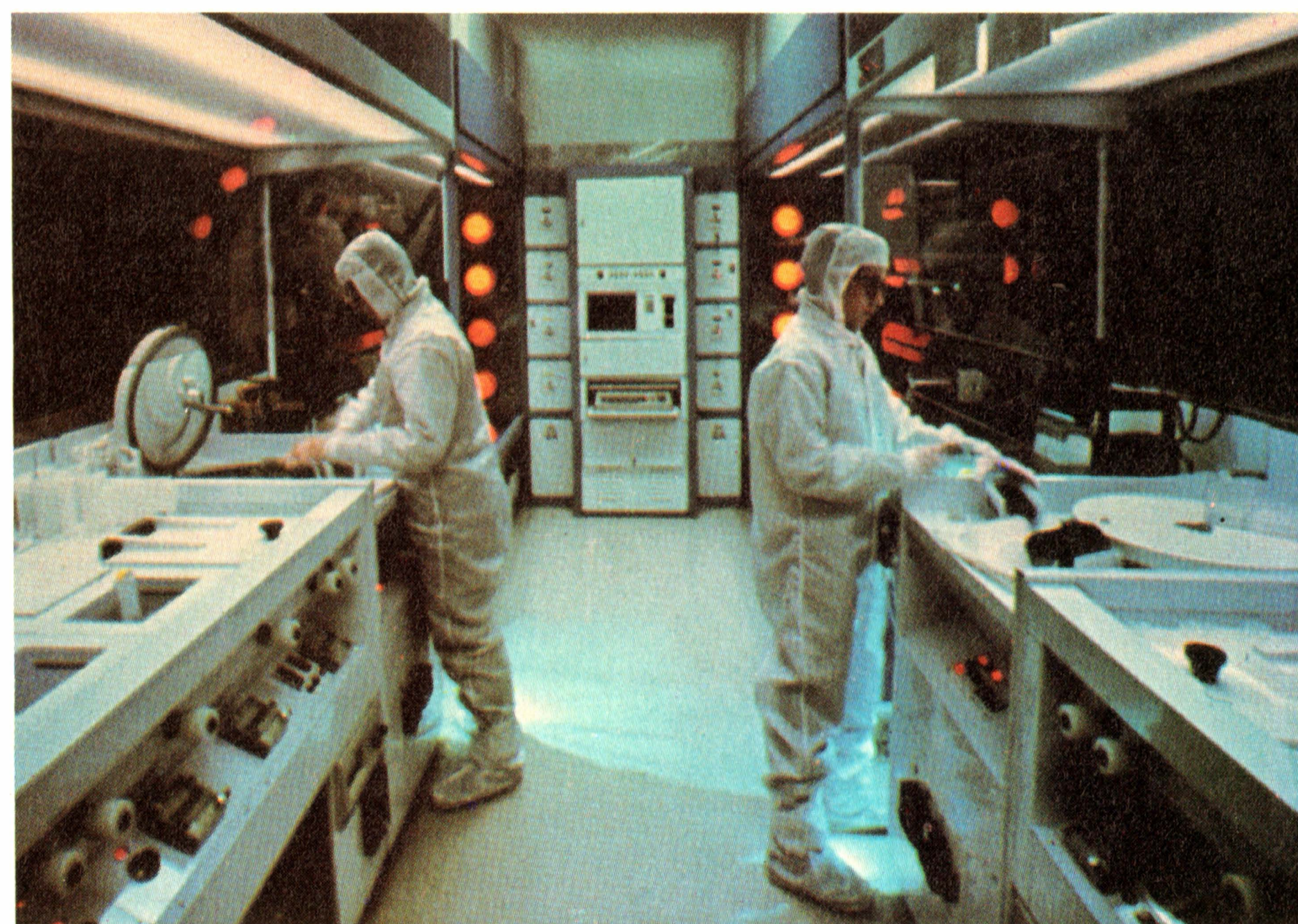
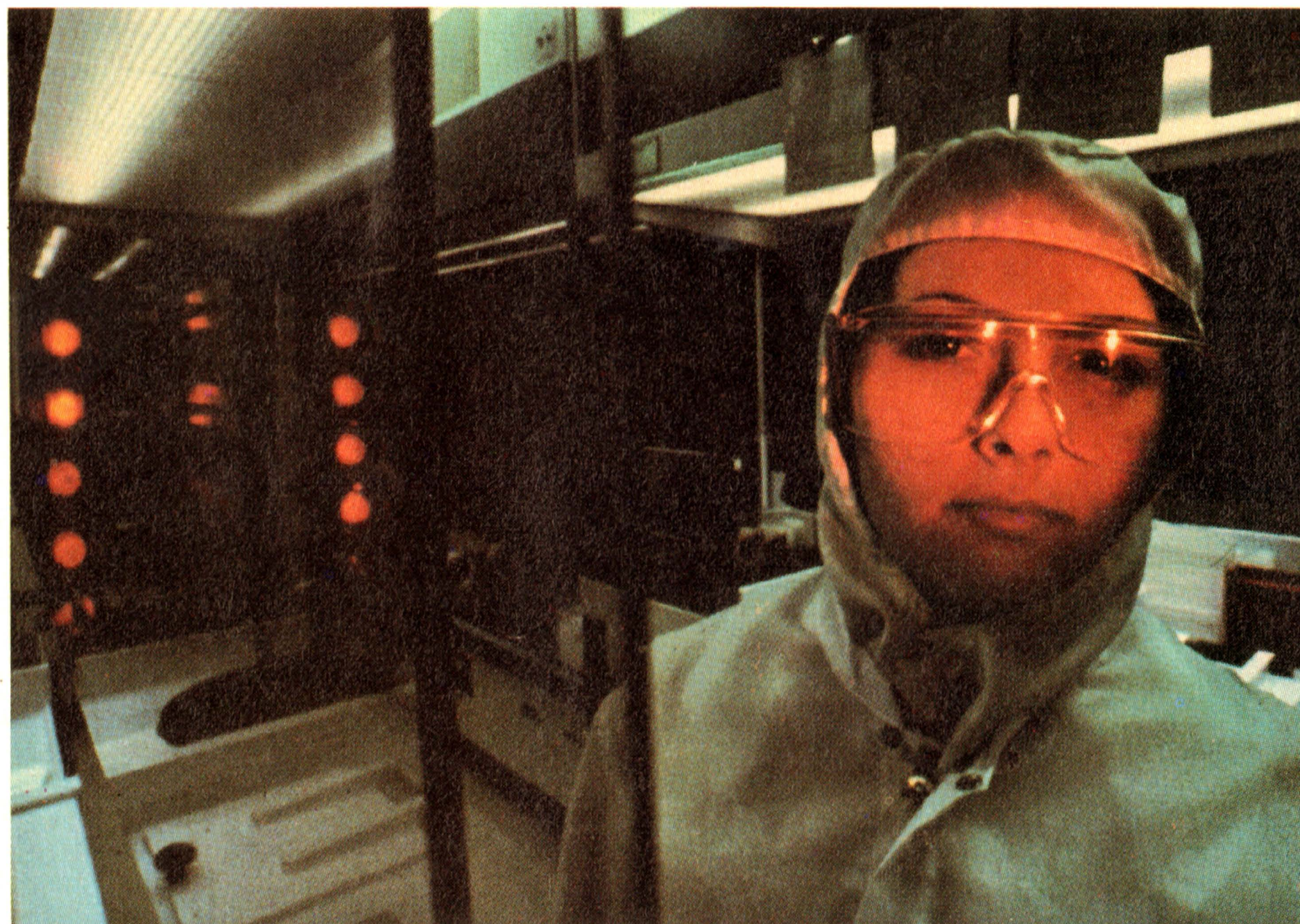
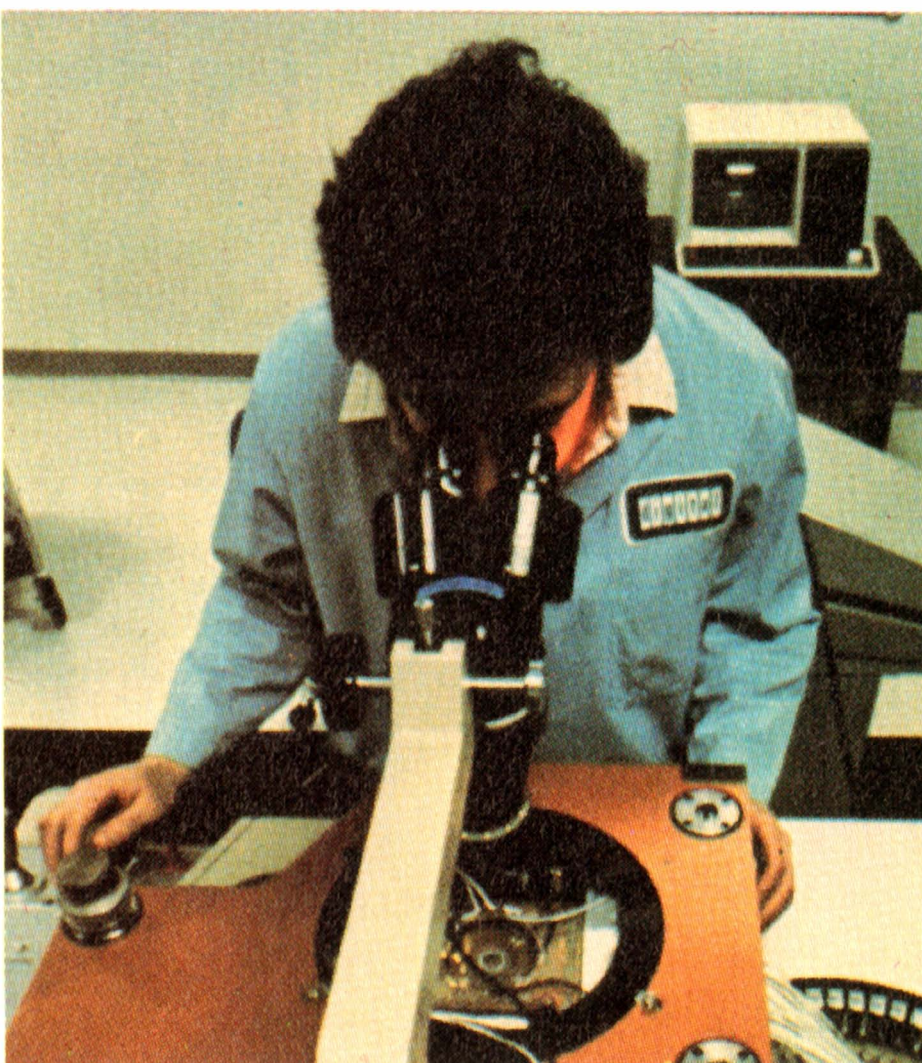
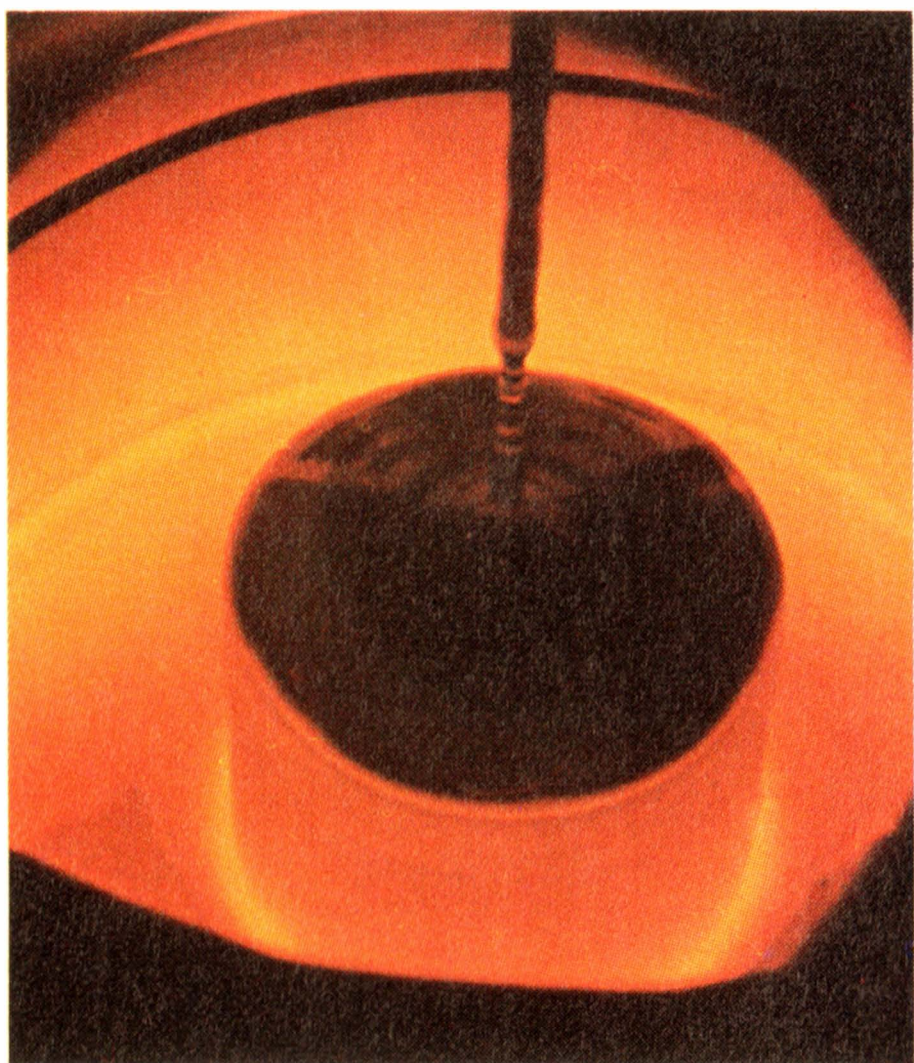
The Integrated Circuit

It wasn't until 1971, however, that computers became small enough for use outside large corporations, colleges, and government offices. M. E. Hoff, a Stanford University graduate backed by the Intel Corporation, invented an integrated circuit with over 2000 transistors on a small sliver of silicon. Integrated-circuit technology mushroomed and today's streamlined chip carries more transistors, is even tinier, and has as much computing power as the first-generation computers. And, while the early computers cost millions of dollars to construct, today's chips can be purchased with a child's allowance.

How a Chip Is Made

Chips are designed by engineers much as buildings are designed by architects. Depending on the chip's function, an engineer may take years to complete a complex design. Drawings can be handcrafted on a drafting table or drawn on a computer (see photos at right). Once completed, the design is miniaturized on a "photomask"—which resembles a photographic negative. The design is repeated dozens of times over a small piece of film.



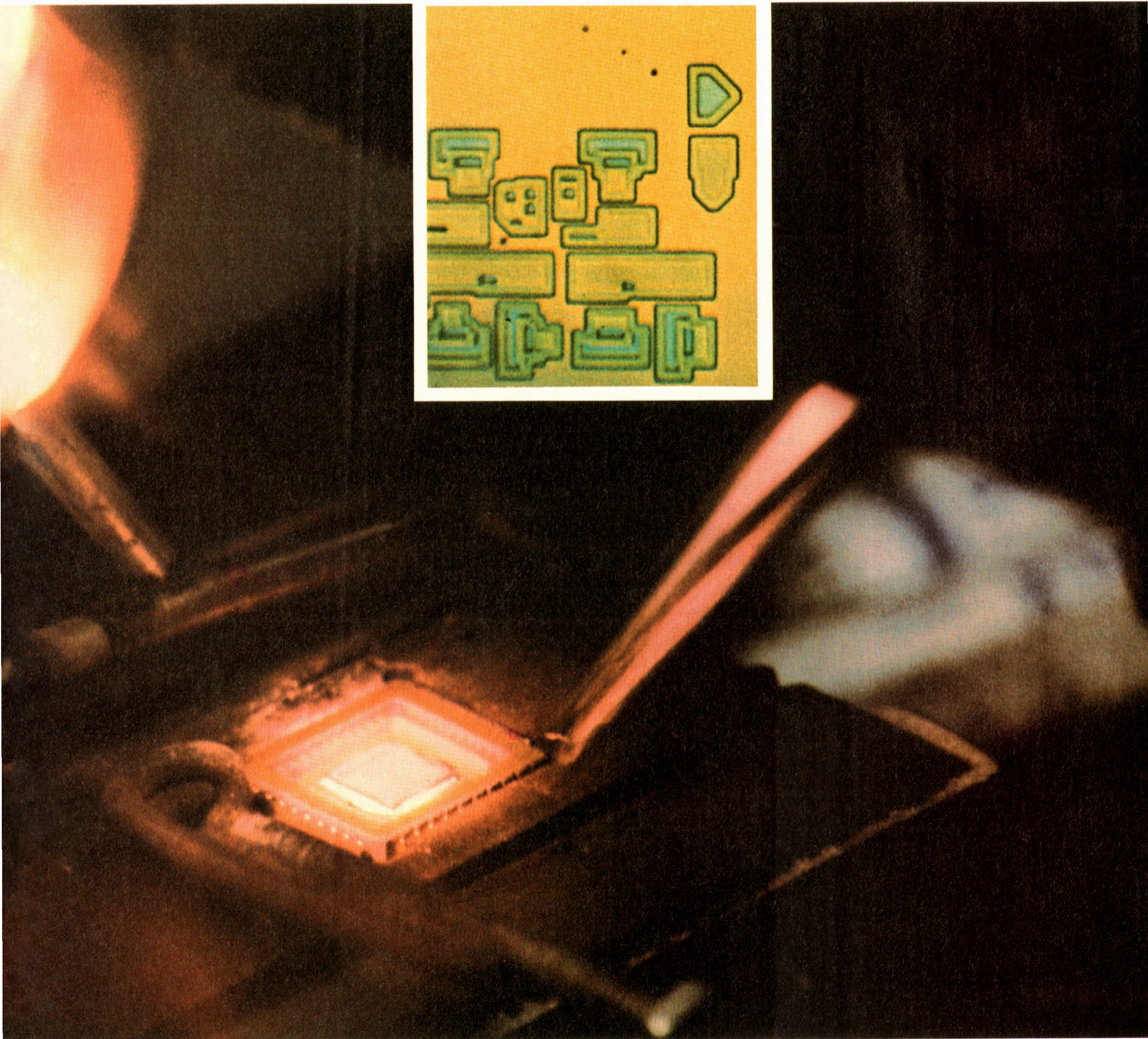


The photomask is then used to transfer the design to a silicon wafer, several inches wide and sliced from a long tube-like silicon crystal, made from purified sand (see photo at left). While silicon and germanium are qualified semiconductors, silicon is inexpensive, abundant, and almost always used for making chips. The design is imprinted on the wafer by a chemical etching process with photosensitive emulsion applied to the silicon that is then exposed to ultraviolet light. An acid bath is used to wash away any unexposed areas. This process can be repeated as many as twelve times, creating successive layers of electrical circuitry on the chip.

Although the design layers have been etched on the wafer, the chips must also include different electrical characteristics to control the flow of electricity. Through a process called "doping," impurities are embedded into the silicon with boron, arsenic, or phosphorus. Doping changes the atomic configuration of the silicon by removing or adding an electron. This results in a positive or negative charge. The transistor effect is created when, for example, two negative areas surround a positive one (see photos at right). Chips can also be doped by a process called ion implantation in which molecules of boron are shot into the silicon with 100,000 volts of electricity. Scientists are currently working on laser technology to embed the impurities. Once the chips have been doped, they're heated for hours in large furnaces while the impurities slowly sink into the various layers of circuitry. Testing begins after the chips are removed from the heat and separated from the other chips on the wafer with a diamond saw. Usually, less than half the chips from a wafer survive the manufacturing process and are usable.



Methods and manufacturing time vary depending on the complexity of design. A chip used in a microwave oven may have only a few layers of circuitry. State-of-the-art chips used in personal computers are much more intricate. Microprocessor chips, the heart of a personal computer, are the most complex chips manufactured today. Most of the steps involved in this process take place in "clean rooms" with air filters to remove the smallest particles of dust and dirt that might contaminate the chips. Employees wear sterilized white jump suits ("bunny suits") for the same reason. Once the chips have passed testing, they are packaged with protective casings of ceramic, plastic, or metal with gold or aluminum soldering. The packaging protects the chips and also provides electrodes for hooking up their circuits to the outside world. A lengthy manufacturing process is now done and the chips are available for a variety of tasks. □



My Computer Likes Me

by George Firedrake and Ramon Zamora

"My Computer Likes Me" is directed toward people who want to help children learn to use, program, and enjoy the TRS-80 Color Computer. These ideas are best applied when a child asks such questions as "How does the computer do that?" or "How can I make the computer do what I want it to do?" or "Can the computer tell me"

We suggest things to do. You explain what is happening, answer questions, modify our ideas, and enrich the adventure with your own ideas. But don't do the typing. Let the kids do the hands-on stuff. Be patient—let them make mistakes, correct their own mistakes, and, especially, encourage them to experiment!

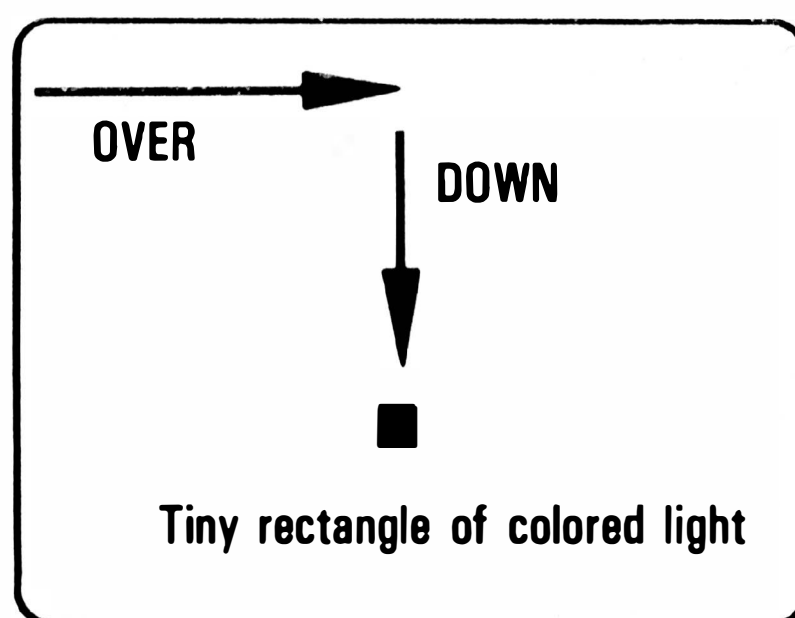
Get SET for Color

Patterns are the subject of this month's column. You'll learn how to put patterns on the screen of your TRS-80 Color Computer, using small rectangles of colored light. To do this, you use the **SET** statement.

► **SET** turns on a tiny rectangle of colored light somewhere on the screen.

Somewhere on the screen? Of course, you must tell the computer *where* to turn on the rectangle of light. You must also choose the color.

SET (32, 16, 3)
↑ ↑ ↑
OVER DOWN KOLOR

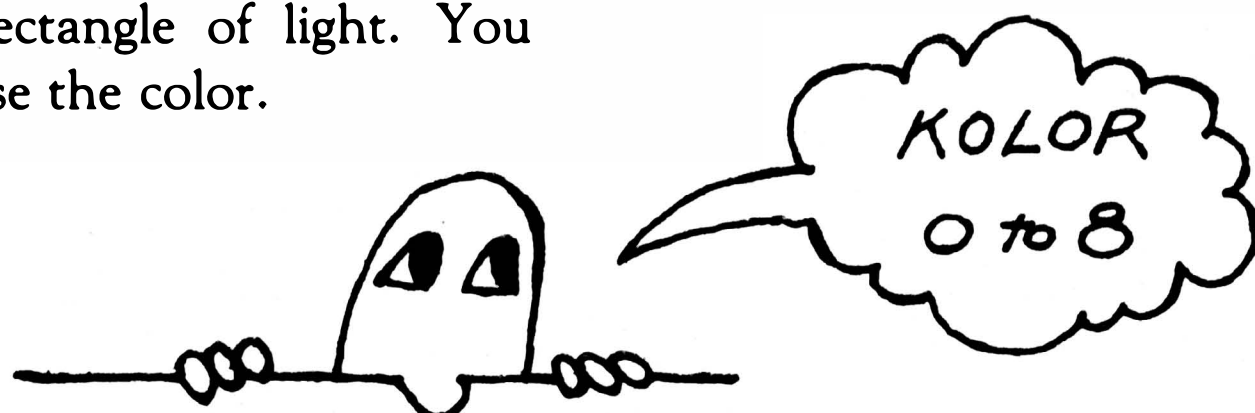
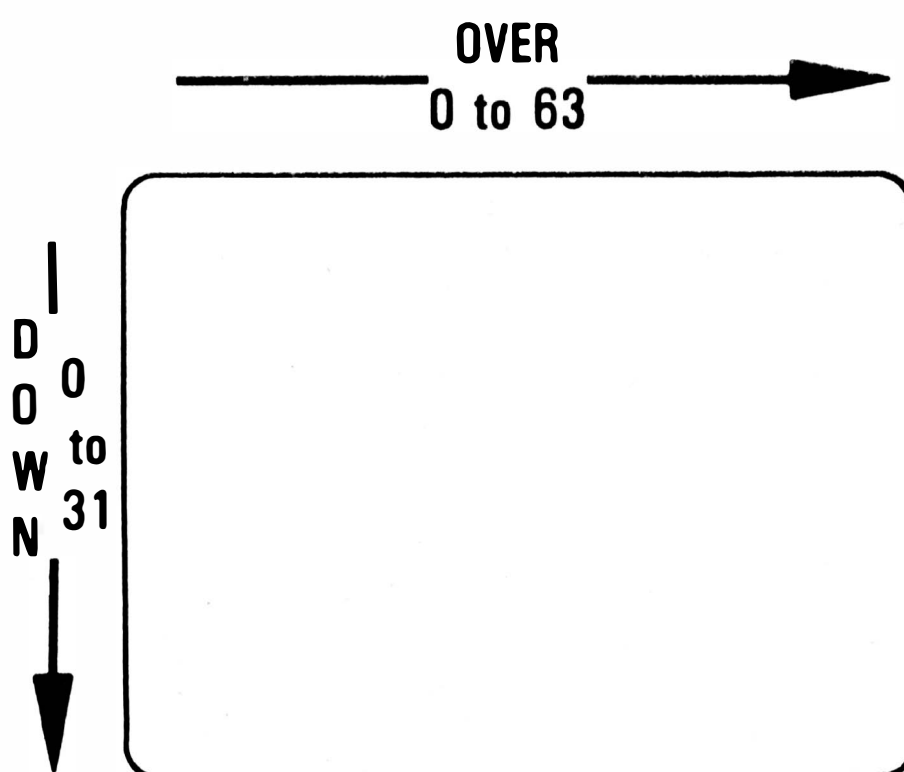


Think of it like this: SET (OVER, DOWN, KOLOR).

OVER can be a whole number, 0 to 63.

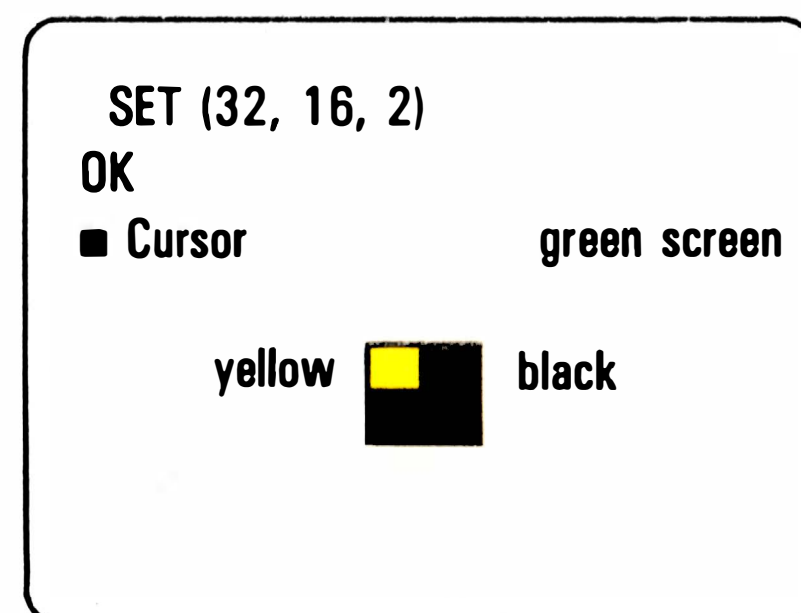
DOWN can be a whole number, 0 to 31.

KOLOR can be a whole number, 0 to 8.

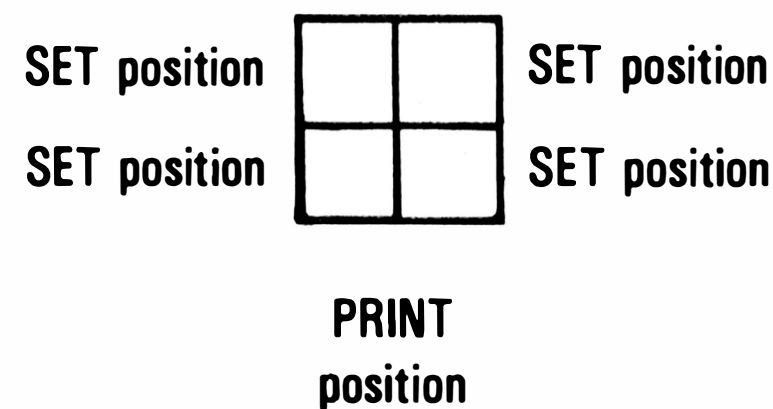


Try one. First, press the **CLEAR** key. Now you see a green screen. Put a yellow rectangle near the center of the screen.

► Type SET (32, 16, 2) and press **ENTER**. This is what you should see:



That's not what we said would happen, is it? You see a yellow rectangle in the corner of a larger black rectangle on a green screen. The larger black rectangle occupies one screen print position. The smaller yellow rectangle is SET in one of the four corners of a print position. Each screen print position contains four SET positions.

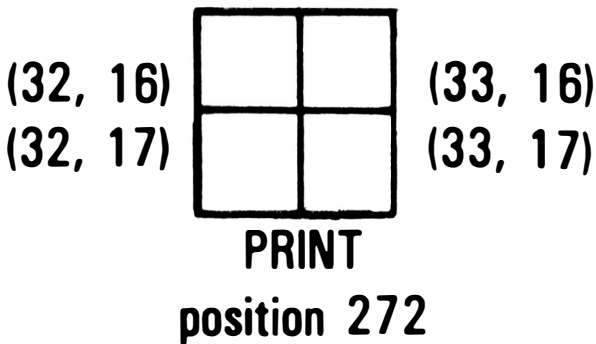


A screen map shows both PRINT and SET positions. Using the screen map, you

can verify that **PRINT** position 272 contains the following **SET** positions:

OVER	DOWN
32	16
33	16
32	17
33	17

Did we hear a faint cry for help? Let's try it one more time.

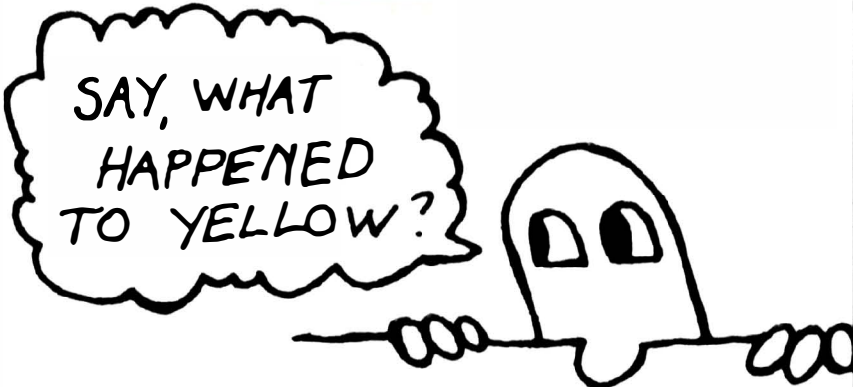
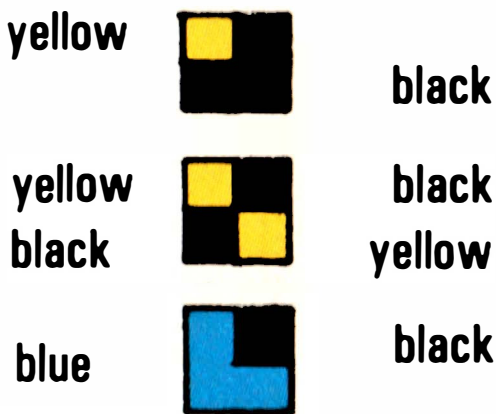


To put some color in screen position 272, here's what you do:

- Press **CLEAR**
- Type **SET (32, 16, 2)**
- Type **SET (33, 17, 2)**
- Type **SET (32, 17, 3)**

This is what you see in **PRINT** position 272:

The entire screen is green.



Perhaps you have guessed that when using **SET**, you can't put two different colors in the same screen **PRINT** position. You can have one color (1 and black. The color will be the most recent color used in that **PRINT** position.

Try this program:

```
100 REM ** EXPERIMENT WITH SET
200 REM ** DIALOG WITH EXPERIMENTER
210 CLS
220 INPUT "HOW FAR OVER"; OVER
230 INPUT "HOW FAR DOWN"; DOWN
240 INPUT "WHAT COLOR "; KOLOR
300 REM ** TINY COLOR ON BLACK SCREEN
```

```
310 CLS 0
320 SET(OVER, DOWN, KOLOR)
400 REM ** VARIABLE TIME DELAY
410 Z = 2000
420 FOR K = 1 TO Z: NEXT K
500 REM ** GO DO IT AGAIN
510 GOTO 210
```

It

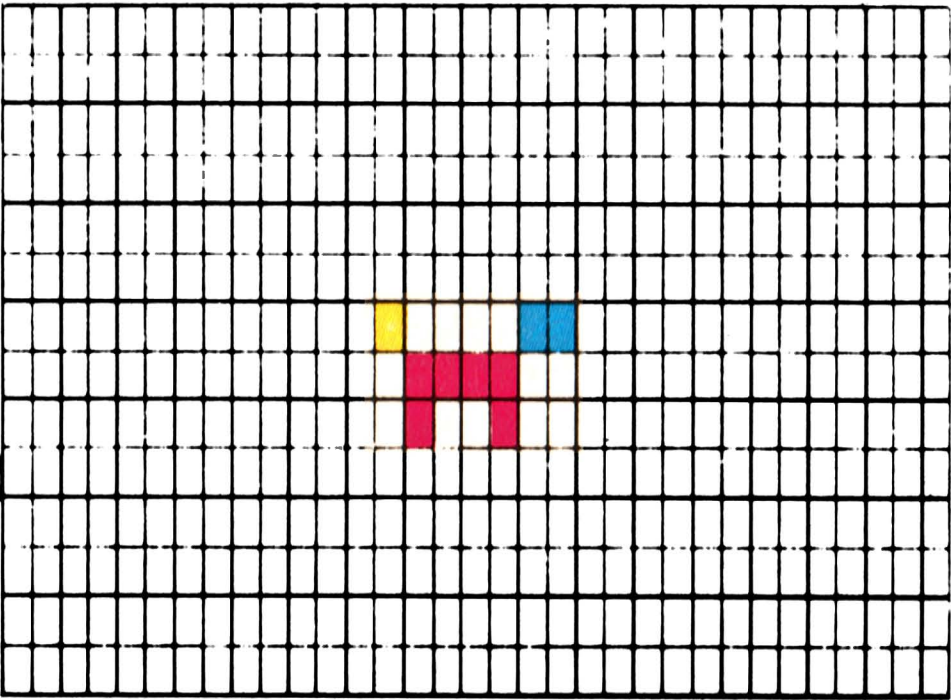
HOW FAR OVER? 32
HOW FAR DOWN? 16
WHAT COLOR? 2 ■ Cursor

Before you press **ENTER**, guess where the tiny rectangle will appear on the screen. Then press **ENTER**. The screen will become all black (see except for a tiny yellow rectangle near the center of the screen.

Variations: Change line 310 so that the screen is cleared to a color other than black. Or change the time delay (1 "viewing time."

Make a Shape

Use the screen map to draw a shape on the screen. For example, here is a red dog with a blue head and a yellow tail.



For this unlikely dog, the **OVER**, **DOWN**, and **KOLOR** codes are shown below.

OVER	DOWN	KOLOR	ANATOMY
29	15	2	tail
34	15	3	head
35	15	3	head
30	16	4	body
31	16	4	body
32	16	4	body
33	16	4	body
30	17	4	leg
33	17	4	leg

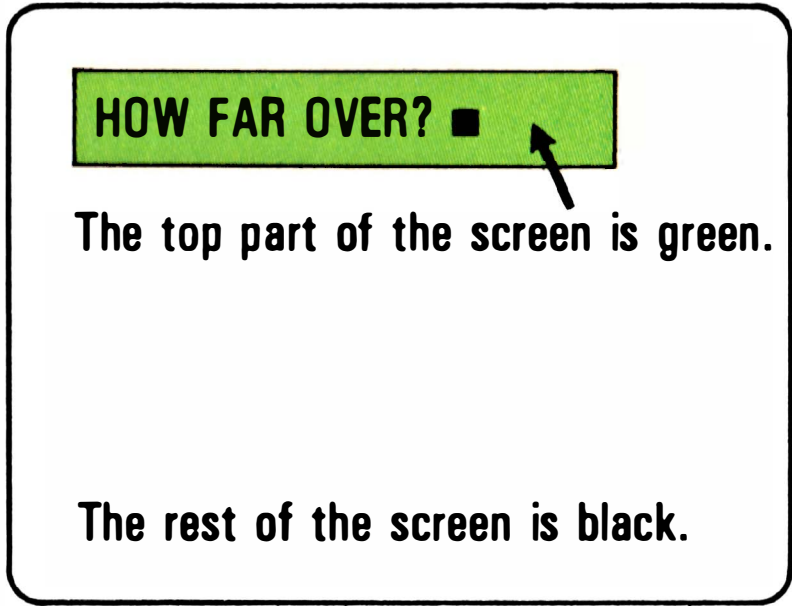
Remember, within a single **PRINT** position, you can use only one color.

Therefore, the body and legs of the dog must be the same color.

You can use the following program to put a shape or pattern on the screen. Use it to put the color dog on the screen.

```
100 REM ** SHAPE MAKER PROGRAM
110 CLS 0
200 REM ** TALK TO SHAPE MAKER
210 PRINT @0, " "
220 PRINT @32, " "
230 PRINT @64, " "
240 PRINT @0, ;
250 INPUT "HOW FAR OVER"; OVER
260 INPUT "HOW FAR DOWN"; DOWN
270 INPUT "WHAT COLOR"; KOLOR
300 REM ** PUT TINY COLOR ON SCREEN
310 SET(OVER, DOWN, KOLOR)
400 REM ** GO DO IT AGAIN
410 GOTO 210
```

Enter this program and **RUN** it. This is what you'll see.



We will call the green part of the screen the "text window." It three lines of the screen. The rest of the screen is black, ready for your tiny rectangles of light. Go ahead—enter the value of **OVER** for the dog's tail.

Now the text window looks like this:



Enter the value of **DOWN** for the dog's tail. Now you see:



That's a yellow tail, isn't it? The code for yellow is 2. Enter it. The yellow tail will appear near the center of the screen and the text window will look like this:

HOW FAR DOWN? ■

Now it's your turn. Enter the information for the rest of the color dog. Then put some other shapes on the screen. An orange bone? A green cat? Hmm. . . perhaps you are wondering how the text window works. It lines 210 through 270.

- First, note that line 110 clears the screen to all black.
- Line 210 tells the computer to position the cursor at print position 0, and since there's no trailing semicolon, erase everything to the right on that line.
- Line 220 clears the second line of the screen to green.
- Line 230 clears the third line of the screen to green.
- Line 240 positions the cursor at print position 0.
- Line 250 causes the computer to print **HOW FAR OVER?** and wait for someone to enter a number, the value of **OVER**.
- Lines 260 and 270 cause the computer to ask for the values of **DOWN** and **KOLOR**.

Starfall

Imagine that the screen is the sky. And pretend that each tiny rectangle of light is a star appearing in the night sky. Make it happen by storing and running this program.

```
100 REM ** STARFALL—RANDOM STARS
110 CLS 0

200 REM ** RANDOM OVER, DOWN,
    KOLOR
210 OVER = RND(64) - 1
220 DOWN = RND(32) - 1
230 KOLOR = RND(8)

300 REM ** PUT STAR ON SCREEN
310 SET(OVER, DOWN, KOLOR)

400 REM ** TIME DELAY
410 ZZ = 100
420 FOR KK = 1 TO ZZ: NEXT KK
```

```
500 REM ** GO DO IT AGAIN
510 GOTO 210
```

When you **RUN** this program, the sky will begin filling with stars. Try to find constellations, shapes, and patterns as the stars turn on. Change the time delay (line faster or slower.

Replace lines 210 and 220 with one of the following variations.

```
210 OVER = RND(RND(64)) - 1
220 DOWN = RND(32) - 1

210 OVER = RND(64) - 1
220 DOWN = RND(RND(32)) - 1

210 OVER = RND(RND(64)) - 1
220 DOWN = RND(RND(32)) - 1

210 OVER = 64 - RND(RND(64))
220 DOWN = 32 - RND(RND(32))
```

Mad Artist

Meet Mad Artist. He loves to paint horizontal color stripes on the screen. You start him by entering the following program and running it.

```
100 REM ** MAD ARTIST
110 CLS 0

200 REM ** RANDOM KOLOR & DOWN
210 KOLOR = RND(8)
220 DOWN = RND(32) - 1

300 REM ** PAINT HORIZONTAL STRIPE
310 FOR OVER = 0 TO 63
320 SET(OVER, DOWN, KOLOR)
330 NEXT OVER
```

```
600 REM ** DO IT AGAIN
610 GOTO 210
```

RUN this program. If you tire of horizontal stripes, add blocks 400 and 500 to show Mad Artist how to paint vertical stripes.

```
400 REM ** RANDOM KOLOR & OVER
500 REM ** PAINT VERTICAL STRIPE
```

you DO THIS

you DO THIS

How about a little musical accompaniment? Add the following statement to block 300.

```
325 SOUND 3*OVER + 1, 1
```

Add the **SOUND** statement of your choice to block 500. You did write blocks 400 and 500, didn't you?

Racing Colors

Ima racing across the screen. The colors advance across the screen by rolling two dice, one green, one red. Make it happen by running this program.

```
100 REM ** RACING COLORS
110 CLS 0

200 REM ** START RACE AT LEFT OF
    SCREEN
210 GX = 0: SET(GX, 16, 1)
220 RX = 0: SET(RX, 24, 4)

300 REM ** ROLL DICE, GREEN & RED
310 GD = RND(6)
320 RD = RND(6)

400 REM ** ADVANCE GREEN STRIPE
410 FOR K = 1 TO GD
420 GX = GX + 1
430 SET(GX, 16, 1)
440 NEXT K

500 REM ** ADVANCE RED STRIPE
510 FOR K = 1 TO RD
520 RX = RX + 1
530 SET(RX, 24, 4)
540 NEXT K

600 REM ** TIME DELAY
610 ZZ = 100
620 FOR KK = 1 TO ZZ: NEXT KK

700 REM ** GO RACE SOME MORE
710 GOTO 310
```

Now, try this program. Yes, we know it has lots of flaws. For example, it ends with an **FC ERROR** when the green or red stripe goes off the right edge of the screen. And the race is slightly biased in favor of green since it advances first. Arise, wearers of the red and undo this injustice!

Next time, we will improve Racing Colors. Meanwhile, try these variations:

- Add sound. Use different sounds for green and red. Crescendo?

- Add the following statements:

```
415 RESET(GX, 16)
515 RESET(RX, 24)
```

With this change, you get two color squares racin

Until next time, we bet on green.



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to know that too. Help us improve by being specific and constructive. See you next month. □

George Firedrake (alter ego of Bob Albrecht) and Ramon Zamora are regular columnists for Popular Computing.

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DragonSmoke

"DragonSmoke" is for everyone involved in teachings kids about computers. We point to resources and sources of information that we have found helpful, entertaining or inspirational in our use of the following computers: Atari 400 and 800; Commodore PET and VIC-20; and Radio Shack TRS-80 Model I, Model III, and Color Computer.

"DragonSmoke" is subjective, opinionated, and definitely *not* supported by scholarly research. It is based on 19 years of personal experience helping thousands of kids learn to use, program, and enjoy computers. We also point to sources of information about such role-playing games as Dungeons and Dragons, Runequest, and Tunnels and Trolls. Opportunity knocks—new ways to learn beckon.

Role-Playing Games

Millions of young people (and some not-so-young) are playing fantasy and science-fiction role-playing games. Kids who "can't read" are reading, understanding, and using rule books for role-playing games—rule books that make a computer reference manual seem simple by comparison. Kids who "can't do math" are successfully dealing with numerical information, probability tables, economics of fantasyland, and polyhedral dice in a way beyond the ken of most adults. No wonder they are bored by the school work of a hundred years ago!

Once there was only Dungeons and Dragons, affectionately known as D & D. Now there are more than a dozen game systems—and still more on the way. We suggest that you begin with these three:

Game System	DragonSmoke Review
Dungeons and Dragons (D & D)	First, and best known
Runequest (RQ)	Royal purple ribbon for best design
Tunnels and Trolls (T & T)	Easiest to learn

Beginners beware! Don't start with the Dungeons and Dragons rule book unless you are adept at deciphering terse cryptograms. It's OK for experts, incomprehensible to beginners.

What Are They?

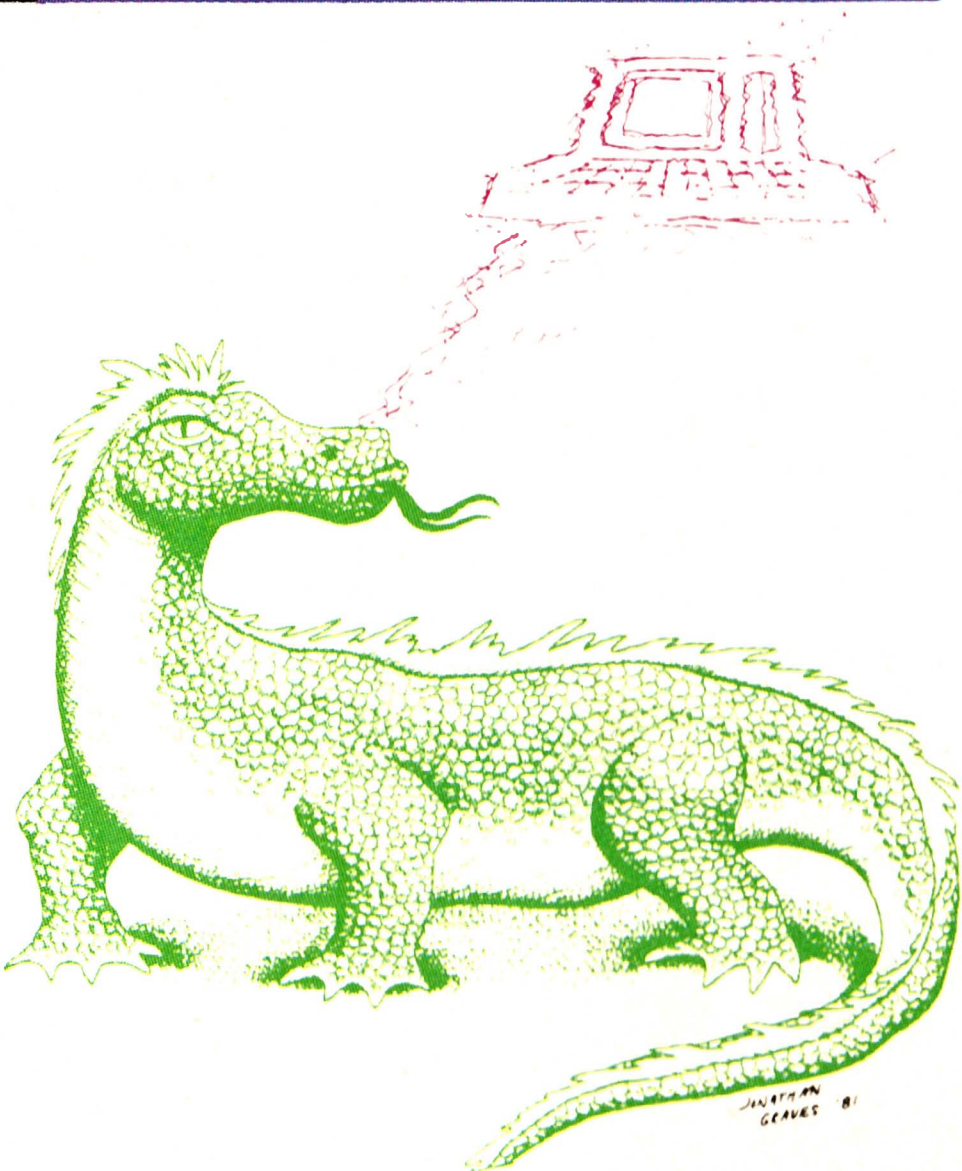
Oh, you've never heard of role-playing games? Beginners start here:

"Basic Role Playing," by Greg Stafford and Lynn Willis. Chaosium, Inc., POB 6302, Albany CA 94706. \$4.95 postpaid.

This is *not* about the computer language BASIC. It is the only booklet (16 pages plus a pullout section) about role-playing games that most beginners can read and understand. The following is excerpted from "Basic Role Playing":

A fantasy role-playing (FRP) game is one wherein the players construct characters who live out their lives in a specially made game-world. The characters need not be anything like the people who play them. Indeed, it is often more rewarding and enjoyable for players to create characters entirely unlike themselves. For instance, the most popular sorts are warriors and magicians—how many knights or wizards do you know in this world?

The game world is operated by a referee (sometimes called a game master, adventure master, dungeon master, etc.) who sets up the situations



which the players confront and who also plays 'the world.'

An FRP game, then, is an interaction between players, who operate (run) characters, and a referee, who runs the world in which the adventures occur.

Most of the play is verbal exchange. The players tell the referee what they wish or intend to do. The referee then tells them if they can or may do it and, if not, what happens instead.

A game can be fantastically dull or fantastically exciting, depending on both game master and players. It can focus on the mechanics of fighting with ancient weapons, the interaction of human and nonhuman personalities (elves, hobbits, dwarves), problem-solving, or anything else within the realm of imagination. A game can be like an improvisational theater, ruled by emotion, logic, intuition, or all of the preceding.

Most, and best of all, a game is unpredictable.

What Next?

Try Runequest or Tunnels and Trolls. Both are available in boxed sets that include everything you need, including dice.

continued on page 68

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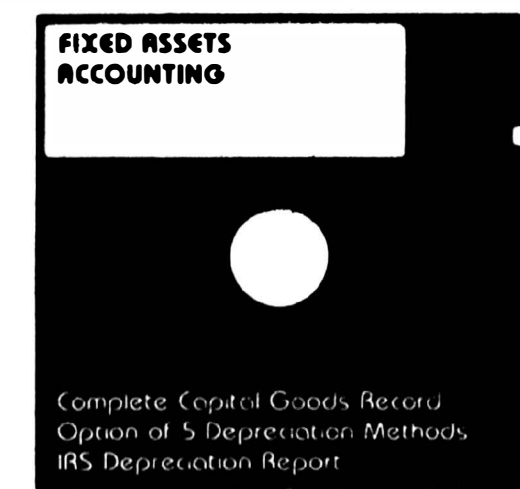
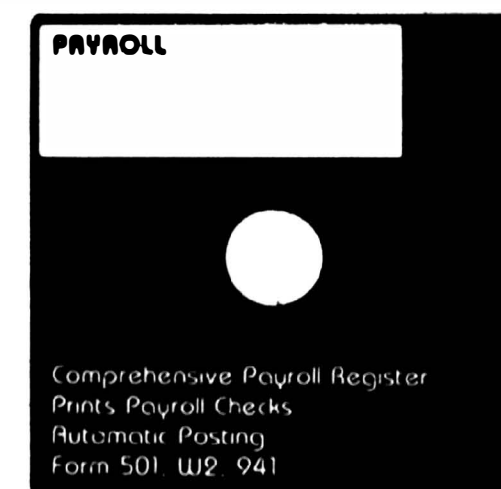
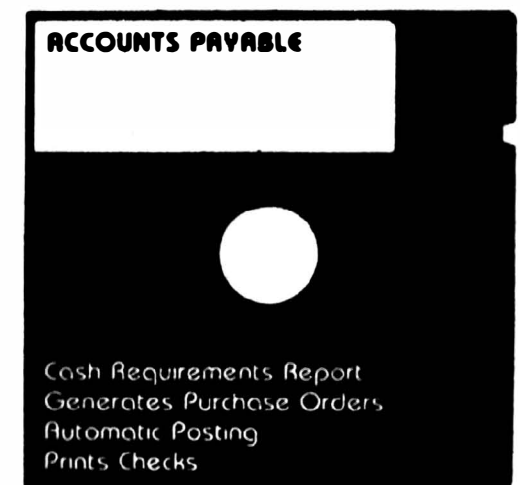
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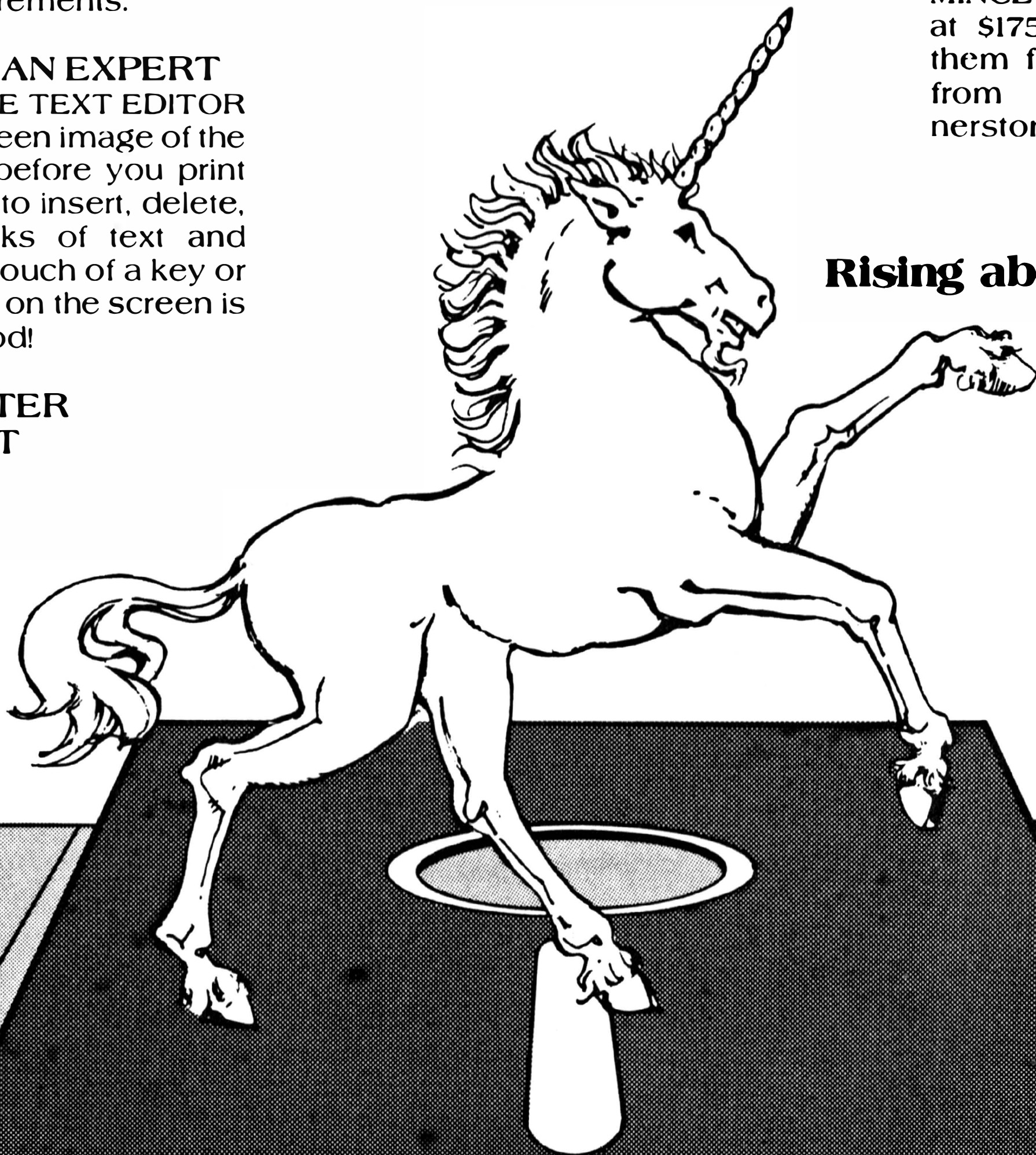
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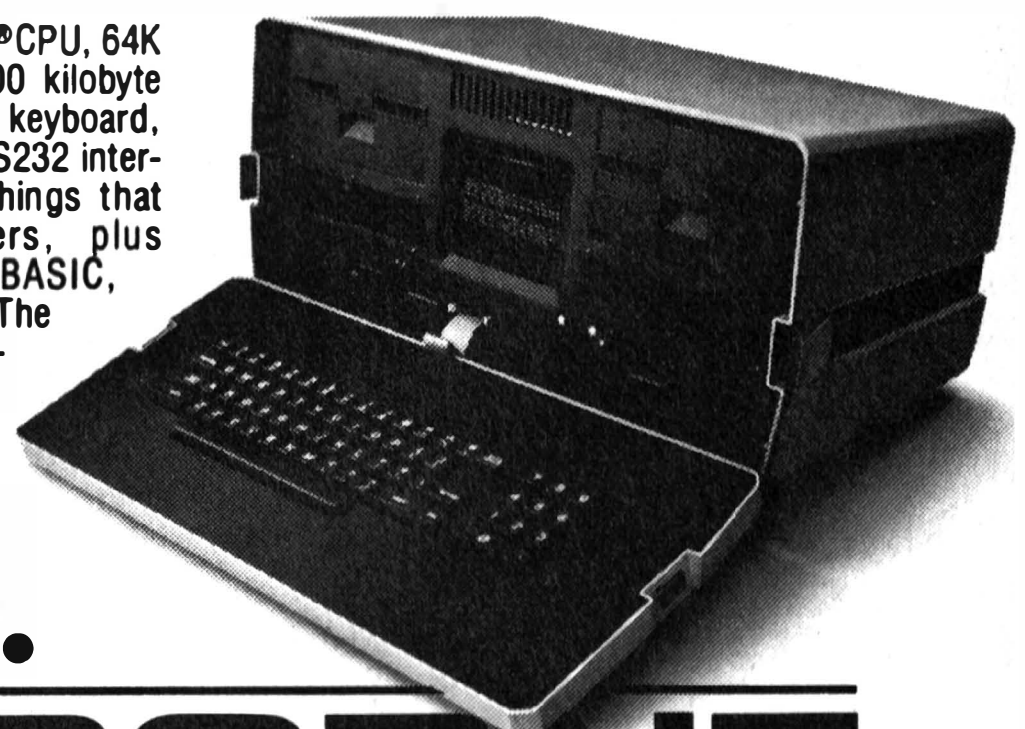
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Runequest, by Steven Perrin and Ray Turney. Chaosium, Inc., POB 6302, Albany CA 94706. \$20.95 postpaid.

This is by far the best-designed game system. If computer software was designed this well, computers in general would have a better image. The following is quoted from the Runequest rule book:

A role-playing game is a game of character development, simulating the process of personal development commonly called 'life.' The player acts a role in a fantasy environment, just as he might act a role as a character in a play. In fact, when played with just paper and pencil on the game board of the player's imagination, it has been called 'improvisational radio theatre.' If played with metal and plastic figurines, it becomes improvisational puppet theatre. However it is played, the primary purpose is to have fun.

Tunnels and Trolls, by Ken St. Andre. Flying Buffalo, Inc., POB 1467, Scottsdale AZ 85252. \$16.95 postpaid.

This game system is the simplest to learn. The rule book is much easier to read, understand, and use than the D & D rule book. T & T is soft and friendly. Here's a sample:

Fantasy role-playing gaming satisfies a great need in most of us—to escape temporarily (if only in the imagination) into a simpler cosmos. In this game we engage in a form of story-telling, with elements of joint participation that are normally missing from other forms of entertainment. Tunnels & Trolls will require that you actively use your imagination, not slavishly follow a set of rules around a world not of your own making. Although there are many 'rules' in the book that follows, please remember this: they are largely intended as guidelines to spare you the effort of re-creating everything yourself from scratch. If you find something you would like to change to make the game more to your liking, then go ahead and change it. There is no 'right' or 'wrong' way to play, only suggestions.

Flying Buffalo also publishes "solo

dungeons," adventures in book form for one player. If you try T & T, try Buffalo Castle, a solo dungeon.

Worlds in Collision

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●Octagon, by Fred Saberhagen. Ace Science Fiction, POB 400, Kirkwood NY 13795. \$2.75 plus \$0.75 postage and handling.

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Computerized Betting

Mike Downing was confident enough to head for Las Vegas with \$5000 in his pocket, a computer, and a small fortune in his dreams.

by Leonard Shapiro

Last June, the *New York Times* carried a front-page story reporting the arrest of a Board of Education computer programmer, Theodore Weg, for allegedly "using school computers to create a race track betting system and to trace the genealogy of horses that he owns."

The story went on to say that New York City's Department of Investigation discovered "a series of programs" with entries from Yonkers Raceway and a "weighted table that created a number for each horse," according to Gordon Haesloop, deputy commissioner. The programs appeared to be part of a wagering system, but there was no evidence suggesting Weg had actually taken or placed bets.

Still, Weg apparently discovered what hundreds of home computer owners already know: their machines can, indeed, analyze horse races and football and basketball games. Also, they can do it with enough success to allow a diligent home handicapper to turn software into hard cash.

Weg, meanwhile, maintains his innocence and insists he'll be cleared of all charges. "I was just doing a little doodling on the things while I was waiting for some jobs to clear," he said. "Anyway, you can't do anything with a computer that you don't already have in your head. Handicapping? Oh, I guess it's possible. But I truly believe you wouldn't be that successful with it unless you could actually take the computer to the track. There are so many

variables, so many things that can change at the last minute. It would be very difficult to make any money with a computer."

But many people in the home computer programming field disagree. Ken Perry, who runs the Systems Design Lab in Redondo Beach, California, successfully markets programs for Apple and Radio Shack TRS-80 computers that handicap horse races and professional football games. He claims his horse racing program will pick between 30 to 40 percent of all winners, and more important, he claims it will return about an 8 percent profit. Based on a highly regarded book, *Winning at the Races*, by William Quirin, a mathematics professor at Adelphi University, Perry's program is so sophisticated, in fact, that bettors can use it to analyze both sprints and longer races.

"The key thing is money management," Perry said. "First of all, you don't play every race—that's foolish. You bet the same amount, and if you do well, you stay with that amount. You have to be very selective, and there's definitely a human element involved here, too. You can't get greedy."

Perry is not a high roller by any means. He takes between \$20 and \$100 to the track every few weeks and is satisfied to come home with a few extra dollars or merely break even. Over the last ten times he's gone, he's only lost once.

The Perry-Quirin system rates horses

in every race and figures the probability for winning on each one. "If you go to the track and see the odds on a horse are 10 to 1, and the system says it's really 2 to 1 (one of the top three horses the system has picked), that's a real good bet," Perry explained.

On sprints, the system takes into account eight factors:

- the number of days since a horse's last race
- how many times the horse has been in the money over its last ten races
- how many times a horse has failed, particularly if the horse drops down in class, say from a \$20,000 claiming race to \$15,000
- the horse's times (or fractions)
- the horse's earnings
- number of starts and average earnings per start over a year
- speed figures, specifically how the horse has run in relation to the track record
- the jockey ratings

For longer races, post position is also a major consideration. In all of this, the computer handicapper gets information from the *Racing Form*, and if it sounds like a tedious process, it is.

Perry insists, however, that once you learn the system, it takes about 15 minutes to analyze each race and about 2½ hours to figure out an entire program. "Normally, a serious bettor who doesn't use a computer will take the same amount of time, if not longer," Perry said. "Not only that, but once he



gets to the track, he's constantly going over his figures between races. I do it one time before I go. Obviously, you look at late scratches and read the tote boards to see what the odds are, but once I've put it through the computer, that's what I'll usually go with."

Perry's system sells for \$39.95 and he's sold several thousand disks. Like most people in this business, he's reluctant to give out names of satisfied customers. "I'm not sure they'd like it known they were doing this, especially with the IRS." He does boast of numerous success stories, however.

"I've had lots of people call and say how much they appreciate it. I don't know about anyone making any big scores, but some people have told me they've won seven out of eight. The program also seems to work better at certain tracks. I had a guy in Denver tell me the program is picking 60 percent winners."

How far would Perry trust his own program? "If I were a rich man, I think it would be worthwhile to go to the track every day. I think you'd have to go out with at least \$5000 to \$10,000 a day to make it worth your while. An 8 percent return on that adds up to something."

Mike Downing of Woodland Hills, California, also known as Joe Computer, helps market Perry's racing program. In his newsletter, *Computers and Gambling Magazine*, Downing said programmers have only begun to scratch the surface of horse racing and sports handicapping. "Most of these techniques aren't well known because the proliferation of home computers has only made a major impact in the last two years," Downing said. "When we get a little more sophisticated—and the time is coming—I really think there will be a great boom in this market."

Again, not everyone agrees.

Last year, Mattel Electronics produced a \$100 computer called the Horse Race Analyzer, proclaiming "thanks to the marvels of modern electronic computer technology, there really is a better way to handicap a horse race." Andrew Beyer, *Washington Post* sports columnist and widely regarded

handicapper, scoffed at the system right from the start.

"The Analyzer," he wrote, "is still based on the same premise that . . . the raw data in the *Daily Racing Form* can somehow be marshaled and weighted to produce a winning formula. [But] successful horseplayers win principally because they have superior information. They may have insights based on watching horses run in their previous starts. They may calculate speed figures that give them precise measurements of horses' ability . . . Above all, they beat the game by using their creative intelligence."

Beyer pointed out that in analyzing 1000 races, the Mattel computer picked only 221 winners. "Considering that public favorites win 33 percent of the time," Beyer concluded, "picking 22 percent isn't much of an achievement. It would be a tolerable result only if the Analyzer were selecting a lot of long-priced winners. But people who have used the device say it gives them mostly short-priced horses."

Carl Iseli, a Silver Spring, Maryland, advertising professional, believes he has a system that would intrigue Beyer and all the other critics. Designed for the TRS-80 and Atari 400 and 800 computers, Iseli calls it the TRIP program (Total Racing Information Program) and is about to market it.

Data input is similar to the Perry system. Iseli takes the top three horses spewed out by the computer and boxes them in exacta combinations. An exacta (perfecta in some states) pays off if the bettor selects the first two horses. For example, if the computer indicates the 1, 2, and 3 horses as the top three in a certain race, Iseli would bet the 1-2, 1-3, the 2-1, 2-3, and the 3-1, 3-2 combinations, or \$12 a race minimum. Because exacta payoffs are usually higher than payoffs for picking just one winner, the net return justifies the increased bet.

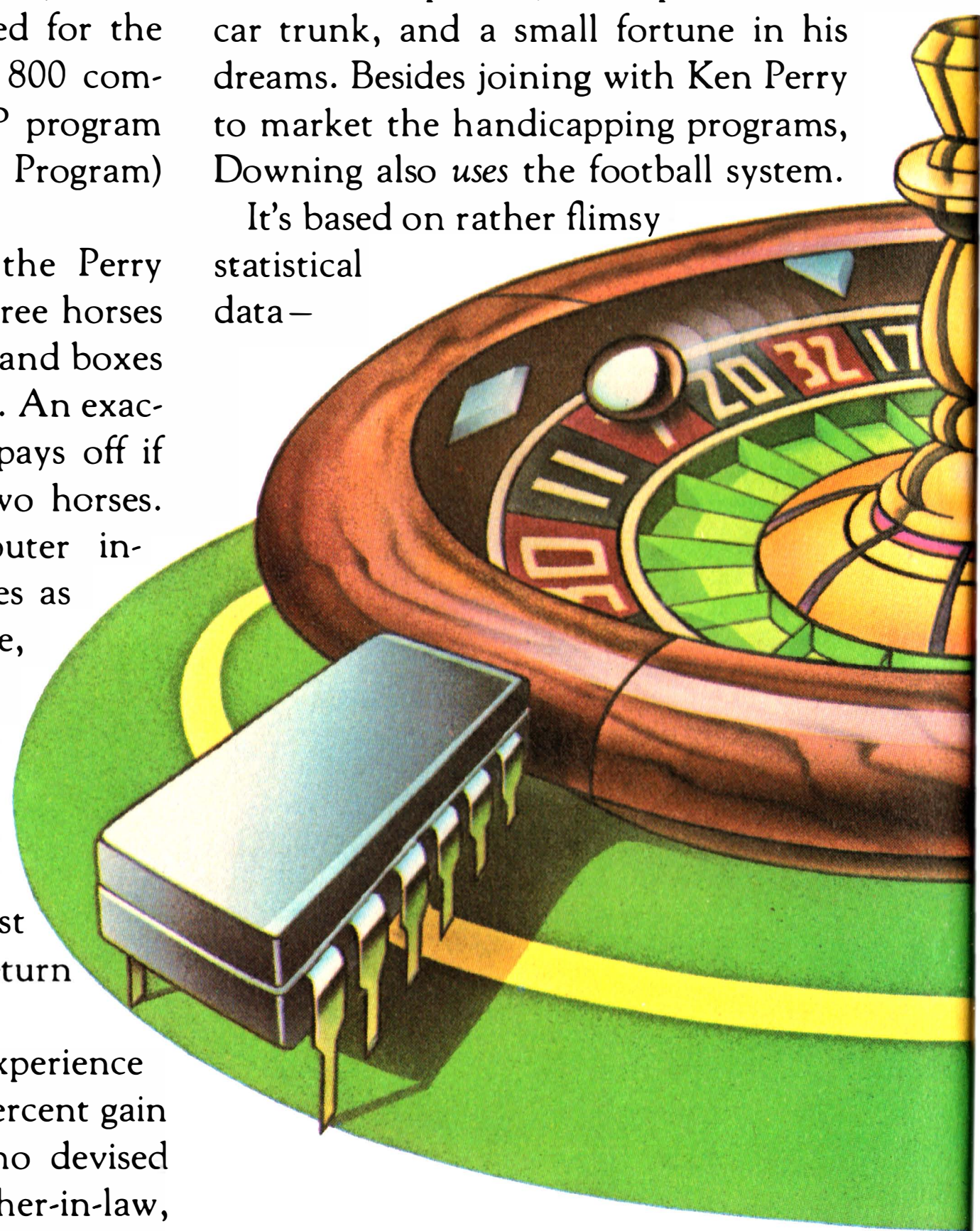
"Using that method, our experience has been that you get a 35 percent gain per race day," said Iseli, who devised the program with his father-in-law,

Charlie Hartmen of Atlantic City, New Jersey. "When he's around, we'll go to the races two or three times a week," said Iseli. "And he often goes every day when he's in Atlantic City. Neither one of us is a big spender. When I go, I'll take \$100. I can't say we've always won. We've been blanked maybe two days out of the last fifty. My best day netted a \$250 profit."

If digitized data on the ponies make gamblers happy, there are smiling faces around the country during the football season as well. Millions of dollars are spent every year gambling on professional football—most of it illegal, whether in office pools, football cards, or heavy-duty stuff with the friendly neighborhood bookie. One gregarious bookie in Washington said he'd love to go head-to-head with a computer because, "How's the computer gonna figure what it means when Walter Payton's got a sore knee?"

With several programs now on the market, that does seem to be a problem. But Mike Downing, at least, was so confident last September he was planning to head for Las Vegas with \$5000 in his pocket, a computer in his car trunk, and a small fortune in his dreams. Besides joining with Ken Perry to market the handicapping programs, Downing also uses the football system.

It's based on rather flimsy statistical data—



scores of past performances and whether the game is home or away. Perry said, "Once again, you have to use some judgment of your own. I mean, if a key player is out at quarterback, obviously you ought to lay off that bet. I don't play anything that looks risky." Claiming his program is 75 to 85 percent successful in picking winners, Perry said that does not take into consideration the point spread put out by Las Vegas. The system is best applied to upset games (games in which the computer disagrees with the Las Vegas line), and in sixty of those games last year the computer supposedly picked forty-four, or 73 percent.

"It's all in how the scores are handled," Perry said. "The score tells you two things: the performance of the offensive team and the performance of the defensive team. The computer goes through about 5000 calculations and builds a power rating for each game. It predicts the winner and by how many points [the game was won]."

"You also have to wait for five or six weeks of the season to use the system. The computer needs that much information, so last year we played from the seventh week on. You get about five upset games a week. We bet about \$100 a game. With who? I'll just say Las Vegas and leave it at that. We won between \$200 and \$400 a week." Would

he gamble full time? "Well, I love pro football, and again, it's a hobby. But I really believe I could live off pro football with this system."

That, of course, is easier said than done. Gerald Strine, author of the syndicated column "Playing Football," said the break-even point for handicappers is picking 52.37 percent against the spread. That takes into account the fact that bookies charge a bettor \$1 if he or she wins a \$10 bet. It's called the "vigorish."

Strine said he was in the 56 to 57 percent range on his picks against the spread last year, and that a good handicapper would probably pick about 70 percent on straight winners without a spread involved. "If they can find a computer that does better, I'd like to see it," Strine said. "I haven't seen anyone use them, but I know what I've heard. Most handicappers will tell you they just don't substitute."

"The guys who use the statistics feel they have the same information in their heads that the computer has. And some of these guys have some pretty exotic statistics. I met a couple of guys from California at a seminar and they said they were looking to bet on teams who had just played four straight games on astroturf and were playing their next game on grass."

"I also see all these so-called touts who claim they're picking 70 or 80 percent against the spread. You just can't do it. I have never heard anyone who I respect claim that over a long period of time they can pick 60 percent against the spread."

Gerald Strine, meet David Bronson, a 20-year-old college student from Chicago, who maintains his computer program picked 75 percent against the spread last year, 85 percent in simple win-lose terms.

Bronson is not a betting man. He does it for fun, he insists, and has never used his system to win more than \$30 on a football card. "Do you know a college student with \$1000 to gamble?"

The program (see page 74) uses offensive yards and points allowed for the season. "It comes down to how many

points the team should score if it's playing a normal game. The more weeks you play, the more accurate the system gets," Bronson said.

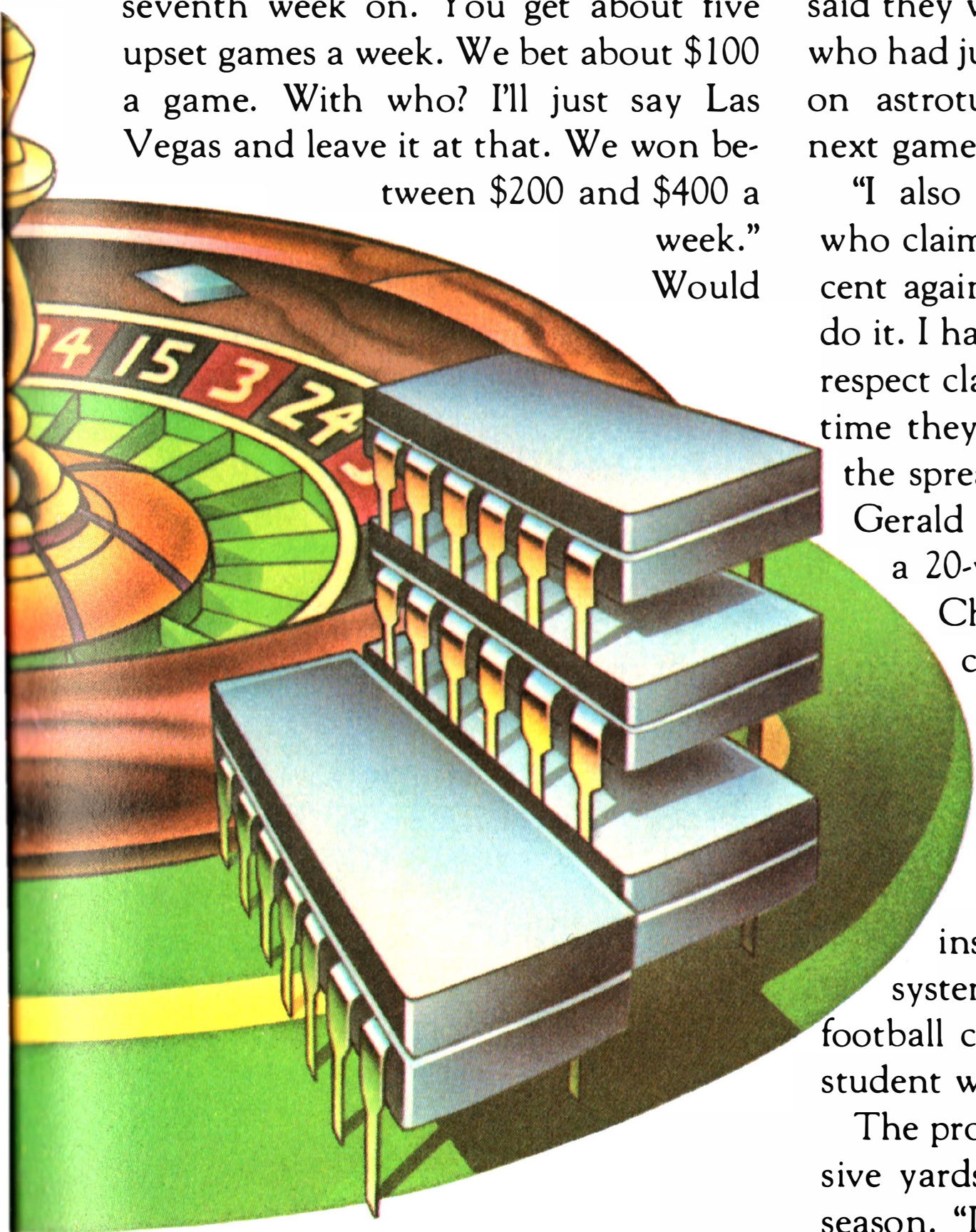
Bronson thinks his program is probably better suited for use in office pools, "the kind where the person with the most total picks for the year wins. The accuracy of it, at least last year, was really amazing."

Another pro football handicapping service designed for recreational gambling use is now being marketed by James Talley of Dallas. Talley also uses past scores and can factor in the home field advantage. "I haven't kept score on the spread," Talley said, "but people have told me it's better than the average guesser. In 1979, it did predict 69 percent win-lose, and that year Jimmy the Greek only did 61 or 62 percent. Last year it was down to about 63 percent winners on my program."

"To tell you the truth, I think you'd have to do a more in-depth study of the factors involved—injuries, the weather, position changes—and do it on a weekly basis. It's strictly a game as far as I'm concerned, and we go to great lengths to make that clear in the advertising for the program."

And not to ignore college basketball fans, Rich Sothen of Bowie, Maryland, has developed his Electronic Handicapper to predict the outcome of regular season play. "A lot of people are using it to enhance their incomes," said Daphne Schor, president of Acorn Software, who plans to market the Electronic Handicapper and Carl Iseli's horse racing program. "I can't tell you any names, but I know one guy who bought a new car and went off to Las Vegas with what he won," she added.

Sothen's system has a simple premise based solely on past performances. The program can handle 100 teams (more than enough to track most major college basketball teams), and all that's required are score updates every week and indications if a game is home or away. "If the computer says another team is going to blow somebody out, that's a game I would want to bet on," said Sothen, who also is content to simply monitor the results, not bet on them.



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"We we put it on the market," he noted. "With cent accurate. Against the point spread, it was 64 percent. And we lost a lot of real close games in that point spread. It could have been higher if somebody had hit another basket or free throw."

Although there are numerous com-

puter baseball and hockey games on the market, no one has come up with a program to help handicap those sports.

But as Rich Sothen said, "I somebody out there is working on it."

Indeed, □

Leonard Shapiro is Deputy Sports Editor for the Washington Post.

ILLUSTRATIONS BY GARY PIERAZZI.

NFL Point-Spread Predictions

by David Bronson

This program will help you predict the results of professional football games, based upon statistics of earlier games in the season. It is written for the TRS-80 disk system (Model I, II, or III), but can easily be adapted to run on most computers with disk BASIC.

The first time you run the program, select the setup option. This will create a disk file to contain statistics on each team of the NFL. Once the system is set up, you can begin to input the cumulative results from games already played. The more results you put in, the more accurate the predictions will be.

```

10  CLEAR 150: REM ... RESERVE STRING SPACE
20  CLS: REM ... TRS-80 CLEAR-SCREEN
30  PRINT "FOOTBALL PICKS, BY DAVID BRONSON"
40  PRINT: PRINT
50  PRINT "THIS PROGRAM WILL LET YOU PICK THE POINT SPREAD"
60  PRINT "OF ANY GIVEN FOOTBALL GAME BETWEEN THE 28 TEAMS OF"
70  PRINT "THE NFL. TO PERFORM RELIABLY, THE PROGRAM"
80  PRINT "NEEDS THE RESULTS OF AT LEAST THE FIRST FOUR WEEKS"
90  PRINT "GAMES. THE MORE RESULTS YOU GIVE THE PROGRAM,
    THE BETTER ITS"
100 PRINT "PREDICTIONS WILL BE."
110 PRINT: PRINT: INPUT "PRESS <ENTER> TO CONTINUE"; R$
120 CLS
130 PRINT "SELECT AN OPTION BY PRESSING THE APPROPRIATE KEY..."
140 PRINT: PRINT: PRINT
150 PRINT "<S> ET UP THE SYSTEM—DO THIS ONLY ONCE PER SEASON,
160 PRINT TAB(10); "THE FIRST TIME YOU USE THIS PROGRAM."
170 PRINT "<U> PDATE THE TEAM FILE—DO THIS AFTER EACH WEEKS"
180 PRINT TAB(10); "RESULTS ARE IN."
190 PRINT "<P> REDICT RESULTS OF A GAME."
200 PRINT "<R> EPORT THE CURRENT STATISTICS."
210 PRINT "<Q> UIT."
220 A$=INKEY$: IF A$="" THEN 220 : REM ... AN INPUT STATEMENT
    MAY BE USED HERE
230 IF A$="S" THEN 310
240 IF A$="U" THEN 570
250 IF A$="P" THEN 880
260 IF A$="R" THEN 1240
270 IF A$="Q" THEN END

```



```

280 GOTO 220
290 FOR I = 1 TO 1000: NEXT I
300 RETURN
310 CLS: PRINT "SET UP SYSTEM: DO NOT PROCEED IF YOU HAVE ALREADY"
320 PRINT "DONE THIS ONCE THIS SEASON, BECAUSE YOUR PREVIOUS"
330 PRINT "RESULTS WILL ALL BE ERASED."
340 PRINT: PRINT "DO YOU REALLY WANT TO SET UP THE SYSTEM?";
350 INPUT "(Y OR N)"; R$
360 IF R$ <> "Y" THEN 120
370 PRINT "SETTING UP SYSTEM ... STANDBY"
380 GOSUB 1430
390 FOR T = 1 TO 28
400 READ TM$
410 DM$ = MKI$(0)
420 LSET T$ = TM$: LSET O$ = DM$: LSET D$ = DM$: LSET PS$ = DM$
430 LSET PG$ = DM$: LSET G$ = DM$: LSET W$ = DM$
440 PUT 1,T
450 NEXT T
460 CLOSE 1
470 PRINT "SET-UP COMPLETE"
480 INPUT "PRESS <ENTER> TO CONTINUE"; R$
490 GOTO 120
500 DATA ATLANTA, GREEN BAY, NEW YORK (GIANTS), CHICAGO
510 DATA LOS ANGELES, PHILADELPHIA, DALLAS, MINNESOTA
520 DATA SAN FRANCISCO, DETROIT, NEW ORLEANS, ST LOUIS
530 DATA TAMPA BAY, WASHINGTON, BALTIMORE, DENVER
540 DATA NEW ENGLAND, BUFFALO, HOUSTON, NEW YORK (JETS)
550 DATA CINCINNATI, KANSAS CITY, OAKLAND, CLEVELAND
560 DATA MIAMI, PITTSBURGH, SAN DIEGO, SEATTLE
570 CLS: PRINT "UPDATE STATISTICS OPTION"
580 INPUT "HOW MANY WEEKS HAVE BEEN PLAYED IN THE
    REGULAR SEASON"; G
590 IF G < 1 THEN 120
600 GOSUB 1430 : REM ... OPEN STATS FILE
610 GOSUB 810 : REM ... DISPLAY LIST OF TEAMS
620 INPUT "TYPE THE NUMBER OF THE TEAM TO BE UPDATED
    (0 TO QUIT)..."; R
630 IF R < 1 OR R > 28 THEN CLOSE 1: GOTO 120
640 CLS
650 GET 1,R
660 PRINT "TEAM:"; TAB(30); T$
670 PRINT STRING$(50,"-")
680 PRINT "OFFENSIVE YARDS:"; TAB(30); CVI(O$)
690 INPUT "NEW INFO"; O1
700 PRINT "DEFENSIVE YARDS:"; TAB(30); CVI(D$)
710 INPUT "NEW INFO"; D1
720 PRINT "POINTS SCORED:"; TAB(30); CVI(PS$)
730 INPUT "NEW INFO"; P1
740 PRINT "POINTS GIVEN UP:"; TAB(30); CVI(PG$)
750 INPUT "NEW INFO"; P2
760 W = CVI(W$): IF P1 > P2 THEN W = W + 1
770 LSET O$ = MKI$(O1): LSET D$ = MKI$(D1): LSET PS$ = MKI$(P1)
780 LSET PG$ = MKI$(P2): LSET G$ = MKI$(G): LSET W$ = MKI$(W)
790 PUT 1, R
800 GOTO 610
810 CLS: RESTORE
820 FOR I = 1 TO 27 STEP 2
830 READ T1$, T2$
840 PRINT I; "- "; T1$; TAB(32); I + 1; "- "; T2$
850 IF I = 13 THEN PRINT STRING$(50,"-")
860 NEXT I

```

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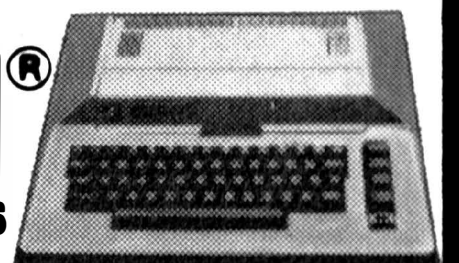
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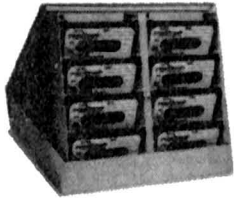
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```
870 RETURN
880 CLS: PRINT "PREDICT RESULTS OPTION"
890 GOSUB 1430 : REM ... OPEN STATS FILE
900 GOSUB 810 : REM ... DISPLAY LIST OF TEAMS
910 INPUT "ENTER HOME TEAM'S NUMBER (0 TO QUIT)"; HT%
920 IF HT% < 1 OR HT% > 28 THEN CLOSE 1: GOTO 120
930 INPUT "ENTER VISITORS TEAM'S NUMBER (0 TO QUIT)"; VT%
940 IF VT% < 1 OR VT% > 28 THEN CLOSE 1: GOTO 120
950 GET 1,HT%
960 HT$ = T$:HO = CVI(O$):HD = CVI(D$):HPS = CVI(PS$):HG = CVI(PG$):G = CVI(G$)
970 CLS
980 GET 1, VT%
990 VT$ = T$:VO = CVI(O$):VD = CVI(D$):VPS = CVI(PS$):VG = CVI(PG$)
1000 PRINT VT$; " AT "; HT$; " ... "
1010 IF G = 0 THEN PRINT: PRINT "NOT ENOUGH INFO.":
      CLOSE 1: GOTO 110
1020 TH = HO + VD:TV = VO + HD
1030 EHG = TH/(G*2):EVG = TV/(G*2)
1040 THP = EHG*7/100:TVP = EVG*7/100
1050 AHP = HPS + VG:AVP = VPS + HG
1060 HHP = AHP/(G*2):VX = AVP/(G*2)
1070 VF = (TVP + VX)/2:HF = (THP + HHP)/2
1080 VVC = (VO/100):VR = (VD/100)
1090 VX = VVC*7:VW = VR*7
1100 HX = (HO/100)*7:HR = (HD/100)*7
1110 VTC = VPS - VX:VQ = VG - VW
1120 HW = HPS - HX:HA = HG - HR
1130 HC = HW/G:VC = VTC/G
1140 HQ = HA/G:VQ = VQ/G
1150 HS = HF + HC - VQ:VS = VF + VC - HQ
1160 SP = VS - HS
1170 IF ABS(SP)<1 THEN 1230
1180 IF SP<-1 THEN WN$ = HT$ ELSE WN$ = VT$
1190 PRINT WN$; " BY"; INT(ABS(SP) + .5); "POINTS."
1200 PRINT: PRINT
1210 INPUT "PRESS <ENTER> TO CONTINUE"; R$
1220 CLS: GOTO 900
1230 PRINT VT$; "AT "; HT$; "IS TOO CLOSE TO CALL.": GOTO 910
1240 CLS: PRINT "REPORTS OPTION"
1250 GOSUB 1430 : REM ... OPEN STATS FILE
1260 FOR P = 1 TO 4: REM ... FOUR PAGES
1270 GOSUB 1360 : REM ... PRINT HEADINGS
1280 FOR T = 1 TO 7: REM ... SEVEN TEAMS PER PAGE
1290 GET 1,(P - 1)*7 + T
1300 PRINT T$; TAB(22); CVI(G$); TAB(29); CVI(W$);
1310 PRINT TAB(35); CVI(O$); TAB(43); CVI(D$);
1320 PRINT TAB(51); CVI(PS$); TAB(57); CVI(PG$)
1330 NEXT T: INPUT "PRESS <ENTER> TO CONTINUE"; R$
1340 NEXT P
1350 CLOSE 1: GOTO 120
1360 CLS: PRINT "TEAM"; TAB(22); "GAMES"; TAB(29); "WINS";
1370 PRINT TAB(35); "YDS"; TAB(43); "YDS";
1380 PRINT TAB(51); "PTS"; TAB(57); "PTS"
1390 PRINT TAB(35); "GAINED"; TAB(43); "GIVEN";
1400 PRINT TAB(51); "WON"; TAB(57); "LOST"
1410 PRINT STRING$(64," - ")
1420 RETURN
1430 OPEN "R",1,"STATS"
1440 FIELD 1, 20 AS T$, 2 AS O$, 2 AS D$, 2 AS PS$, 2 AS PG$, 2 AS G$,
      2 AS W$, 96 AS ZZ$
1450 RETURN
```


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The Kid, the Apple, and Me

by Carolyn Benson Cohen

Computers represented the wave of the future, and who wants their kid to be late for the future?

Let me begin with a parent's true confession: all my kid knows about computers was learned in the gutter. We didn't discuss such things at home. When my boy began to get curious, he had to go to the streets for answers to his questions. It wasn't that we didn't care; we just didn't

The first indication I had that his tastes were maturing was when he asked for a \$20 subscription to a computer magazine. It was a big jump the five bucks we'd doled out from time to time for the cheery periodicals of childhood.

"Y
you want that magazine for?"

"I
"R
numbers and symbols. . . ." Then I remembered the little notebooks he'd been leaving around the apartment lately, little notebooks filled with—you guessed it—numbers and symbols. I turned the pages of the magazine, one eye on my blue-jean sneakered son, one eye on the fat, glossy publication. It boasted a lot of words, as well as those mysterious numbers and symbols, and a few of the words made sense to me. I was very much in favor of his reading words. And his birthday was coming up. "O.K., but you're going to have to explain this one to your father."

The very next day the boy started

asking if the magazine had come yet. When it finally arrived, they both disappeared until dinner. The evening was spent on the phone mumbling unintelligible numbers and words to unnamed friends.

We had further indication that his interests were expanding when he began to drop hints about his computer savvy. This was a child who usually kept us starved for information his life, egotism, we perked up our ears. In fact, as parents sometimes do, we tried to take advantage of mood to serve our own needs:

"T
history?"

With great aplomb he vaulted over more sensitive areas and kept to his topic: "Y
gram Kenny and I made up after school today!"

"K
we knew all his friends.

"O
kids."

Computer Science, with the aid of three PETS (sm
and cats) and a terminal hooked up to the computer of a nearby university, was taught in the seventh and eighth grades of our son's private school. He was a sixth grader but, I gathered, he spent his leisure time hanging over the shoulders of those more qualified

the equipment. Such was the beginning of his computer experience: "O
against the wall, kid. I'm an authorized user!"

Soon he was disappearing after school to the homes of several of those boys, particularly to that of only as "A
numbers he left on the kitchen table, I discovered a network of computer jun
kid was hanging around with some of the local high-tech addicts.

One of the boys had a mother who taught at the school and after a P.T.A. meeting I cornered her with some questions. She bragged that she had just bought an Apple II Plus for
was astounded—we had reached a whole new plateau in keeping up with the Joneses! She told me about the clever and unusual programs her darlings were writing and offered advice about what to buy when the time was right. "Y
16 K," she warned, and for the first time I learned that my child had needs that could be measured in Ks. Ks of what, I had no idea.

For several months my husband and I mulled and mused. Could we justify such an expense? And yet, from all we had been told by the school and by our son himself, Computers represented the wave of the future. Who wants their kid to be late



Illustrations by Chris Demerest

for the future?

Meanwhile, somebody's mother was teaching my child FORTRAN. He had gotten wind of the faint possibility that we might buy a computer and had jumped into the fray with no subtlety whatsoever. He talked about it all day. Every night before he went to sleep he lay in bed like an angel, whispering another reason why we should have a home computer. We kissed him good night and tiptoed away as he quoted memory capacities and lists of available software.

To make a long story short, we reviewed the bank account, reappraised the budget, rethought the issue, and relented.

Now, imagine that you have \$1,000 or more and are going to spend it on your child. You talk to all the experts, confer, make a decision, and inform the boy of your beneficence, right? Wrong. In our case, what we knew about buying a computer could fit into a salt shaker. My husband's business associates were either blank when it came to home computers or suggested something simple "so the kid can play games." So where did we go for advice on how to spend this large sum of money? To our son. His largest purchase to date had been a \$40 electronic kit on which he spent an entire summer's earnings and with which he got a much-needed "A" on a science project.

The responsibility didn't faze him.

For several weeks he phoned and visited the pubescent underground of computer junkies, debated the respective qualities of the Commodore PET, the TRS-80 Model II, the Apple II Plus, and other machines with curious names and numbers, and stopped in to see his buddies at Radio Shack (where he had become well known by programming their demo). Finally the Apple emerged triumphant, and we ordered it from a company in California.

One day, not long afterward, the kid was home with a cold. He lay limply across the sofa, the huskiness of his unpredictable voice exaggerated and thickened with congestion. With a television set propped at his feet he was a docile patient, although I found his lethargy disconcerting.

When the doorbell rang I rushed to answer, thinking my son was fast asleep. There was the United Parcel Service delivery man holding a big box labeled Apple. I wondered why my parents were sending apples instead of oranges from Florida and then the truth dawned. "Mom," I said to myself, "you're going to see a real show."

I called softly to the boy, who drew himself up from some inane rerun. "Come here a minute."

When he saw the box his lassitude fell away like the afghan he had been clutching about his neck. He began to leap about like someone on a pogo

stick. "It's the Apple! It's the Apple!" his poor voice cracked and bellowed. The UPS man stood with his mouth open looking at the two of us. When the pogo stick settled down to earth, he helped us tear open the box.

"Save the instructions!" I shouted as the boy triumphantly lifted out the carefully packed pieces. But he knew what everything was. I was the dangerous one, almost discarding an extra 32 K bytes of uninstalled memory we had ordered. Spotting something that looked like a row of staples, I thought it was part of the packing. "Mom! Don't!" the kid screamed, just in time.

We quickly moved some furniture and I set up a card table for the Apple, leaving the boy to figure it all out. Frankly, I was on the retreat to a room where I knew how everything worked. When school was out, he placed an emergency call to Kenny.

"Who's Kenny?"

"He's a kid who has an Apple. He knows how to install extra memory."

Across town faster than a speeding bullet, Kenny banged on the door. "Mom, this is Kenny Adams," my boy said. A swarthy child with a Kellogg smile stood poised on the threshold.

"You mean, this is Kenny and Adams? I thought they were two separate persons!"

Kenny walked in with an air of authority befitting his superior

knowledge. He grabbed the Apple from its perch on the card table and trotted with it under his arm to the kitchen. "Gotta have a room with no rugs," he explained, as I rushed to move things out of the way. With a flick of Kenny's wrist, the top sprang off the Apple and we all peered inside. It was practically empty! On the bottom I saw a shallow



layer of what looked like black Lego blocks. Kenny stuck his head, hands, and the extra Ks inside the computer, and soon declared that all was well.

The day the Apple arrived, the parade of boys began. Soon I had met all the unknown kids whose computers my son had visited. Most had first and last names by now. Some came bearing extra disk drives, some with games programs, some just to test, play, and program the latest Apple. They were nice children, of various ages and even more various sizes. They didn't ask for food, but if it was offered, they cleaned me out. They were clever and funny and polite, and thoroughly wrapped up in the world of computers. I've felt much better about the gutter and my guttersnipe ever since!

As for me, I sat down at the computer with the manual one day when

the kid was in school. "Push the switch into an upward position," I read. "You will be rewarded by the 'POWER' light at the bottom of the keyboard coming on." I pushed the switch. The 'POWER' light came on. A smile spread over my face. □

Carolyn Benson Cohen is a freelance writer living in New York.



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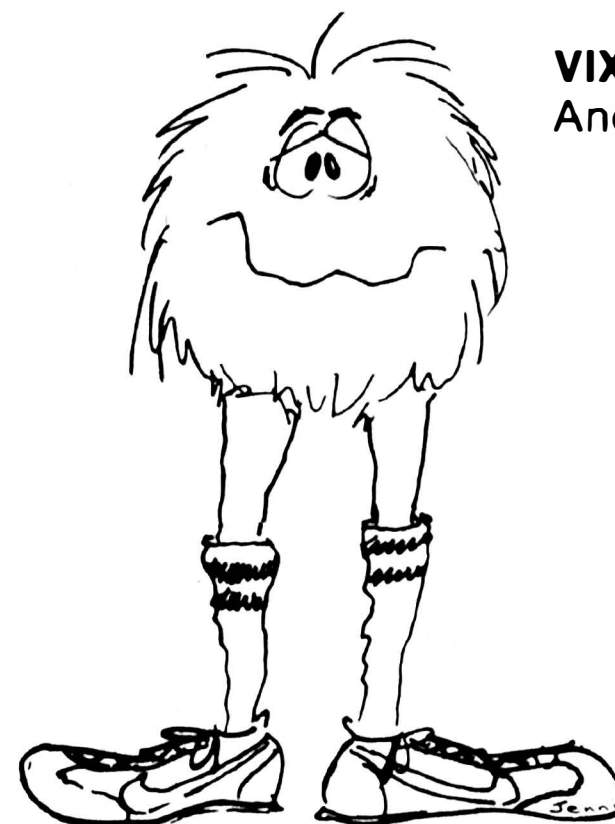
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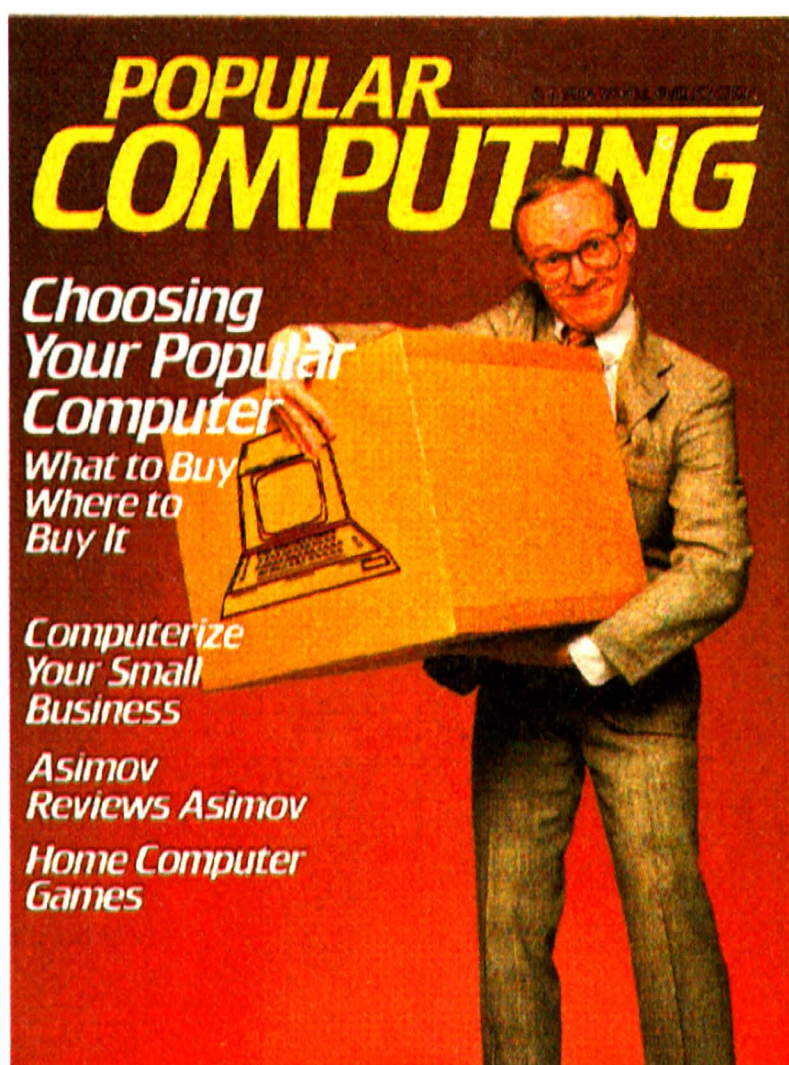
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What Do You Do After You Plug It In



by William Barden Jr.

You didn't fall for that computer salesman's line, did you? You didn't believe him when he promised you instant profits in pork bellies with your new software package? You didn't let him convince you that you could write your own 10,000-employee payroll program in BASIC in a single afternoon? And you didn't agree with him when he told you that a company with a billion dollars in sales couldn't possibly sell equipment that fails when you plug it in?

What, you did all those things? And now you own a thousand dollars' (or two or five) worth of computer gadgetry and you want me to help? All right. I'm ready to divulge the facts as I know them, and in the process I'll give you some advice about how to proceed after you turn your computer on. But you'd better sit down first. How about a drink? You may need it.

The More Things Change

In the 20 years I've been around computers, maxicomputers or mainframes have shrunk from room-size monsters to desktop machines. Their tiny cousins, microcomputers, fit into desk drawers. Purists may point to computer scientists as far back as the 1800s, but digital computers actually have been around for only 40 years. My experience, then, spans half the computer age.

But the more computers change, the more they remain the same. Problems that plagued early computer scientists continue to irk us today. I'll explain some of those as we go along. Bear in mind, however, that I'm a cynic. That's good for you if you're a victim of future shock or if you're convinced that a small computer system is omnipotent. What you need are some cold, hard facts. Take another swig of that Perrier, and read on.

The Hardware

Your new Apple or TRS-80 is basically a good piece of *hardware*. Hardware refers to anything mechanical—your central processing unit, the memory that's in the computer, the cables connecting the units, the system line printer. Your system's design is the least of your problems. Major manufacturers like Apple, Radio Shack, Commodore, Atari, Xerox, and IBM have excellent hardware designs based on microprocessor chips (the Z80, the 8080, the 6502, and the 8088) that have been around for several years.

If you own a microcomputer manufactured by a smaller company, you may experience some problems. Smaller companies tend to be understaffed and undercapitalized, which occasionally can translate into poor hardware design. (Then again, Apple

started off as a garage-shop operation.) Use caution in buying equipment from smaller companies, but rest assured that much of today's hardware is solidly designed.

Even when hardware design is sound, its fabrication may be poor. Quality control varies from company to company. In fact, it is entirely possible to purchase a \$4000 personal computer that does not work when you unpack it from the box. Or you could end up with one that works initially but fails after several hours.

Initial Testing

Your first step, then, is to verify that the system is working properly. Assemble it one step at a time. If you have optional equipment such as printers and disks, set them aside for the time being. Plug in the central processing unit (CPU) cabinet/display and see if it acts the way the operation manual says it should. Then carefully hook up the optional equipment. *Always* turn the power off when interconnecting the various units. Power pins may be inadvertently connected to nonpower pins or vice versa, and a bad connection for even a fraction of a second could cause some of the integrated circuit (IC) chips to burn out.

Of course, the catch here is that manufacturers don't always provide a step-


```

100 REM PROGRAM TO RUN FOR BURN-IN.
200 FOR I=0 TO 30000
300 PRINT I:
400 NEXT I
500 GOTO 200

```

Listing 1: A BASIC program like this one, which continually displays new data on the screen, can help you check your system's operation.

by-step procedure for connecting the system and confirming that all components are working. You could spend hours reading the instructions for inter-connecting things without being able to figure out whether a printer is properly connected. For help, you can muddle through the manuals, ask other people who own the same system, or call the store that sold you the system.

System Burn-In

Let's assume you've managed to get the system together and it appears to be working correctly. The next step is to "burn in" the system. The IC chips are prone to electrical failures that happen more frequently during the first dozen

or so hours of operation. So leave your system running and make periodic checks to see whether it's working properly. One good method is to key in a BASIC program that continually displays new data on the screen. If the program stops or "hangs up," you may have a hardware failure. A sample program that will work on many computers is shown in listing 1.

Eventually, your system will fail. A survey I did several years ago indicated the mean time between failures (a widely used industry phrase, abbreviated MTBF) for one microcomputer manufacturer was two and a half months. I suspect the time is somewhat longer now, as the system in question has been redesigned.

To protect yourself during the warranty period, exercise the system as much as possible by running a variety of programs with all system devices. The catch is that in order to really put the system through its paces using the RS-232C (serial) option for data communication, the printer, and the full capability of the disk drives, you must be very familiar with the system. That familiarity may take longer than the 90-day warranty period.

If you run into problems during the burn-in period, be prepared to wait as long as several weeks for repairs. Computer repair centers may not stock such exotic items as printer heads, disk-drive motors, and special read-only memory (ROM) firmware.

To avoid future troubles, you may want to investigate service contracts that cover parts and labor. Some manufacturers offer contracts for which you pay about three percent of the cost of the system each month. Service contracts have been around for years among larger computer manufacturers,

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and they're valuable when you can't afford to have your system down for any extended period of time. Other companies have a carry-in policy requiring the owner to bring the system into the shop. I remember one disgusted National Weather Service administrator who was forced to drive 200 miles in a blinding rainstorm to the nearest service center after his minicomputer was struck by lightning. His experience illustrates the importance of convenient repair facilities.

I don't mean to paint a totally gloomy picture of the maintenance of your computer system. On the bright side, it's possible for a full-blown system with printers and disks to work for more than a year without problems. That's a far cry from the vacuum tube computer systems of the 1950s, when mean time between failures was hours—less than the time it took to solve the computing problem!

Software Options

With luck, you've managed to escape hardware problems. You've deciphered the operations manual, hooked up the cables, loaded the BASIC or operating system, and burned in the system. From here on, it's simply a matter of *software*, the computer programs that will run your business, home, or school applications.

Microcomputer hardware development has always preceded software development. Although manufacturers have made incredible price breakthroughs in hardware, software is still expensive to develop. Most microcomputer manufacturers must be dragged, kicking and screaming, into developing software for their products, just as their minicomputer predecessors had to be forced to develop support software for their product ten years ago.

When it comes to software, you have four options: run an existing applications program, develop and write your own, modify an existing applications program, or hire somebody to write a custom program.

Off-the-Shelf Programs

I'm writing this article with an off-the-shelf word-processing package, and

I honestly don't know how I got along without it. I consider the program totally reliable, proving that it's possible to purchase packages that work. Other excellent applications programs, such as VisiCalc (see page 38), are powerful tools for business and other applications.

But good applications packages have only recently become available, and they can be extremely difficult to find. When you do find a quality package, expect to pay handsomely for it. Good accounts receivable/payable, general ledger, inventory, and mailing list packages may cost hundreds of dollars each—a fact rarely stressed by salespeople intent on selling you a system. Because programmers often can earn more as independent contractors than as employees of microcomputer manufacturers, applications software provided by manufacturers sometimes falls short of professional standards.

It's possible to buy a \$4000 personal computer that goes on the blink as soon as you plug it in.

In addition to high cost, applications software suffers from some other problems: documentation tends to be less than perfect, and the operation is apt to be inflexible. Inadequate documentation can be disastrous. I once spent an entire day trying to figure out which key to press to terminate a command to an operating system. Neither the manual nor the factory was any help.

Ideally, you should be able to mold an applications package to your specific needs. You should, for example, be able to print out an inventory report in the format of your choice. But in reality, the user is almost always forced to adapt to a rigid format.

Doing It Yourself

It's possible to write your own applications package, but you should give careful thought to the problems involved. Your system probably came with BASIC, which is a high-level computer language. When the salesman told you that BASIC is easy to learn,

he meant easy compared to other computer languages.

You can learn to create simple BASIC programs in a matter of hours, or dozens of hours at most. But it will take literally hundreds of hours before you're familiar enough with BASIC to develop an accounts receivable package or any other applications code. Think about how long it took you to become familiar with the elements of chemistry or the rules of English grammar.

In addition to learning a language, be it BASIC, COBOL, or Pascal, you must simultaneously gain experience with the system's operating commands, disk-file management, teleprocessing, and so forth. This continuing process is closely linked with the language you're learning. To store inventory files on disk, for example, you must know the techniques to access the files, the capacity of the disk, and the speed at which files are stored and retrieved.

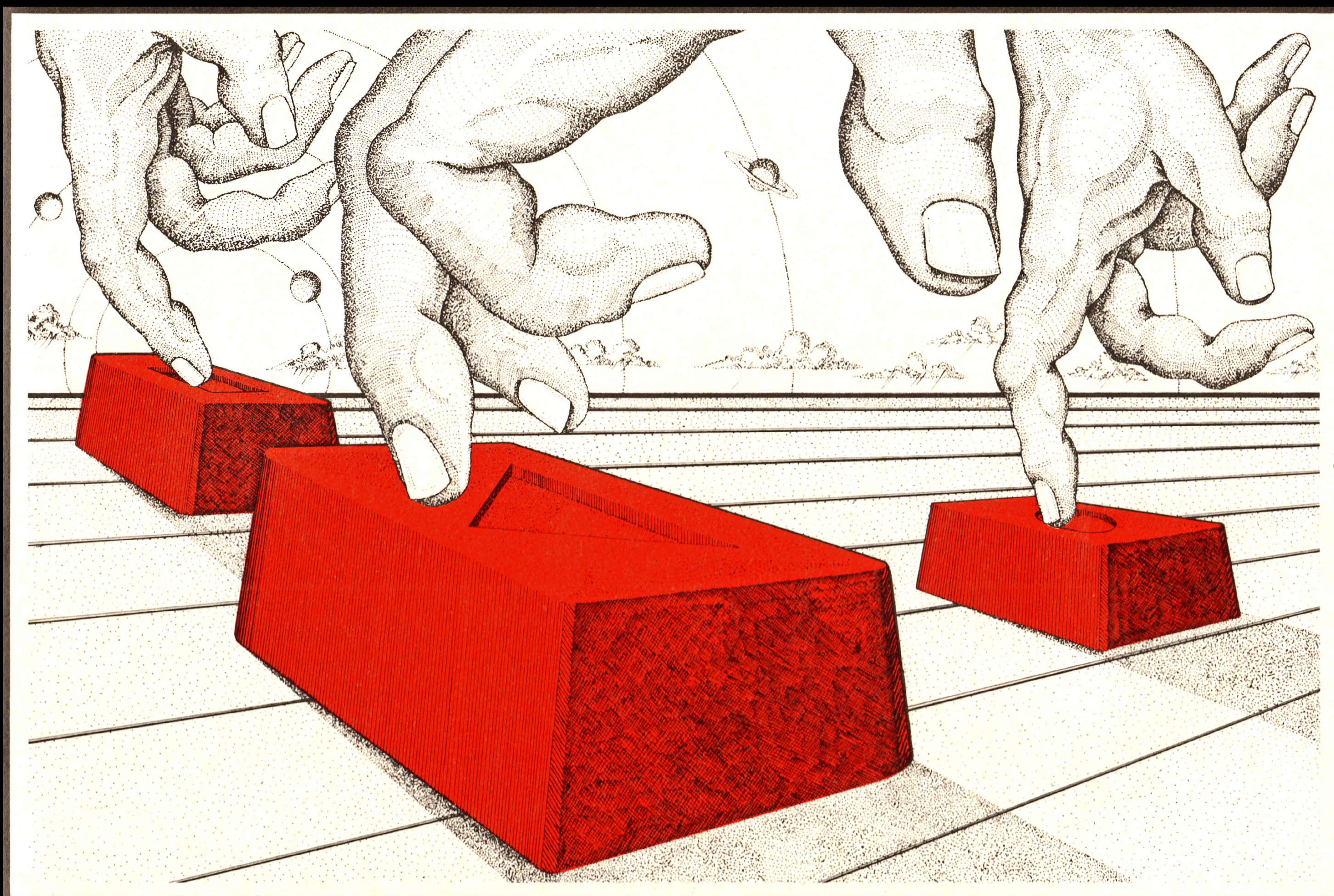
Modifying Existing Programs

Taking a BASIC program and changing it to suit your needs presents several problems. First, the BASIC program may be virtually unreadable because it has been "compressed," meaning program statements have been combined to make fewer lines, and spaces between words have been eliminated, as shown in listing 2.

Second, figuring out what is going on in an existing program can often take as much time as writing the program from scratch. The design phase accounts for much of the time spent developing a program, and you may have to do a lot of deciphering before you can begin making changes in an existing program.

The last alternative for finding the perfect software is to pay someone to develop an applications program geared to your special requirements. For some guidelines on how much this might cost, let's talk about how rapidly programs can be written.

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110 H$="0123456789ABCDEF"
120 LINEINPUT"
FILESPEC: ";FS$:ONERRORGOTO9000:OPEN"I",1,FS$
125 ONERRORGOTO0:CLOSE:OPEN"R",1,FS$:SN=0
130 FIELD1,255 AS D$
140 LINEINPUT"
SECTOR NUMBER (OR 'ENTER' FOR NEXT SECTOR): ";S$
150 IFS$=""THENSN=SN+1ELSESN=VAL(S$):IFSN<1THENCLOSE:GOTO100
160 GET1,SN:IFPEEK(14312)>127THENPRINT"LP NOT READY":GOTO 140
170 LPRINT" ";L          "FS$;TAB(35)"SECTOR: "SN:LPRINT" "

```

Listing 2: A BASIC program that has been compressed. Beginners may have trouble unraveling such programs because statements are combined and some spaces are eliminated.

Industry standards for assembly-language programs are about 25 lines per day. A line is equivalent to one instruction, such as "add a number" or "subtract a number." Standards for BASIC and higher-level languages are not as well defined, but probably about the same number of BASIC lines can be generated per day, with each BASIC line performing many more operations than the typical assembly-language line.

The line-per-day figures represent the beginning-to-end development of a typical applications program—from initial design through coding, debugging, and documentation. An approximate graph of development times for microcomputer BASIC programs is shown in figure 1. Note that smaller programs reach a limit time because of the overhead of using the system. Larger programs take longer to design and debug simply because they present more possibilities.

The typical BASIC applications program is about 1000 lines, with several programs composing a package for specific applications like inventory or general ledger. Each program, therefore, takes about 50 days to produce, and the complete package takes correspondingly longer, depending on the number of programs it contains. Assuming a reasonable rate of pay for the programmer, plus some overhead, say \$25 per hour, we have three programs per package multiplied by 50 days per program multiplied by 8 hours per day multiplied by \$25 per hour, or a grand total of \$30,000 per package. Clearly, then, hiring outside help is not a

reasonable alternative for a \$4000 system.

Your System, Your Friend

As you venture into the world of software, your first task is to make friends with your system by learning as much as possible about it. Although wading through the manual isn't easy, it's the perfect way to begin your friendship. Become familiar with microcomputers in general and with your system in particular. Even if you run only existing applications programs, you need to know how to load the operating system from disk, enter the date and time, read the contents of system disks, and set up your printer for report generation. Unfortunately, the day of the turnkey system with an ON/OFF button for an application is a few years away.

BASIC is the staple language of microcomputer systems, and all signs

point to its remaining that way for some time to come. Even if you have your sights set on COBOL or Pascal, I'd advise you to first master the rudiments of BASIC, which forms a common bond between various microcomputer systems. Because many BASIC interpreters were written by Microsoft, the various systems in BASIC share common ground.

Regardless of whether you plan to write your own programs, you should learn to program in BASIC. I recommend self-teaching books on BASIC specifically oriented to your system, such as the Albrecht series (published by John Wiley & Sons and dealing with the TRS-80, Atari, and others) or some of the manufacturers' books, such as Radio Shack's *Getting Started with TRS-80 BASIC*. Although the BASICs on different computer systems are similar, there are enough differences to

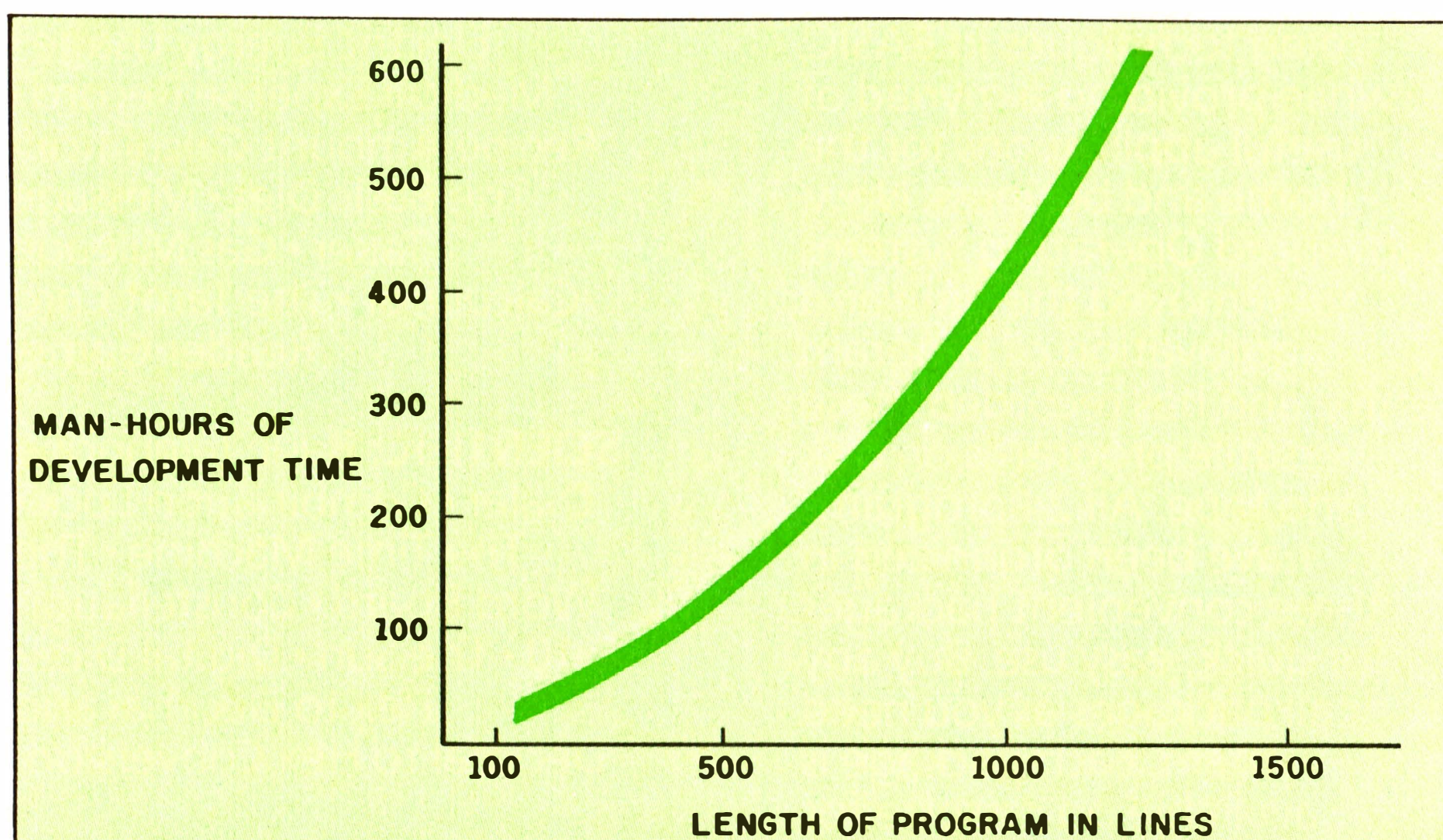


Figure 1: Development times for microcomputer BASIC programs increase markedly for longer programs. Figures used in graph are approximate.

make learning a “noncompatible” BASIC (one not written by Microsoft) a frustrating experience.

Developing Your Own

While you’re studying your system, learning a language, and practicing running applications packages, try your hand at developing your own programs. It’s possible that programming is not for you, but give it a chance. You may find it’s easy to write your own applications programs and modify existing programs.

Develop good habits right from the start by documenting your program well. Surprisingly, 75 percent of the cost of programs used in industry goes into maintenance—the process of going back to an existing program and correcting errors (bugs) and deficiencies. For every hour spent developing a program, another three hours are spent fixing or modifying it. Most of the time, inadequate documentation is the culprit.

For simple programs, you can write out the code any way that works. To generate a larger program, however,

you’d do well to follow this procedure:

- Write a rough specification for the program, describing what it will do and specifying the appearances of input forms, displays, and reports.
- Rough out the design of the program. How will you handle disk files? How large will data records be? What functions will be handled?
- Chart the flow of a program. Not all programmers use flowcharts, but it’s a good idea to experiment with them in the beginning. A flowchart uses somewhat standardized symbols to represent major program actions, as shown in figure 2.
- Code the program. For a small program you can simply enter the program statements from the keyboard. But for a larger one it’s best to write down the statements on a coding sheet, and then “desk-check,” or scrutinize, the program before entering it into the computer.
- Debug the program. This step accounts for as much as 50 percent of the complete program development cycle. It involves running the program, checking for errors, entering

the data most likely to cause errors, and modifying the program until it works.

- Document the program. You should include some notes in the program itself by means of remarks or similar statements. After the program is done and completely debugged, sit down and document what is happening in the program and how you accomplished certain things. Then, when you find an error eight months from now, you’ll be able to refer to your notes and make repairs relatively easily.

These six steps are somewhat *iterative*, a fancy way of saying you may have to revert to an earlier step, such as designing or coding, after debugging has revealed a logic error in the program. Unfortunately, the more inexperienced you are in program design and development, the more often you may have to repeat certain steps.

Well, I see you’ve gone through several bottles of my best mineral water during my presentation on small computers. Perhaps you think I’ve been too harsh on small systems, but I prefer the word realistic. If you’re prepared to fight inferior documentation, mediocre programs, and lousy service, the rewards are great. Your small computer system can perform accounts receivable or inventory, relieving you of hundreds of hours of manual labor each year and allowing you to do things that just weren’t possible before.

I’ve played the devil’s advocate in this column. In future columns, I’ll examine some of the areas glossed over here—software costs, communications, disk file capability, software speed, and using other manufacturers’ equipment with your system. For each topic, I’ll avoid the idea that a computer can solve every problem easily. It’s simply not true. Instead, I’ll outline potential problems and their solutions to guide you toward the most efficient possible use of your system. □

William Barden Jr. will be a regular columnist for Popular Computing. His latest book is Microcomputers for Business Applications.

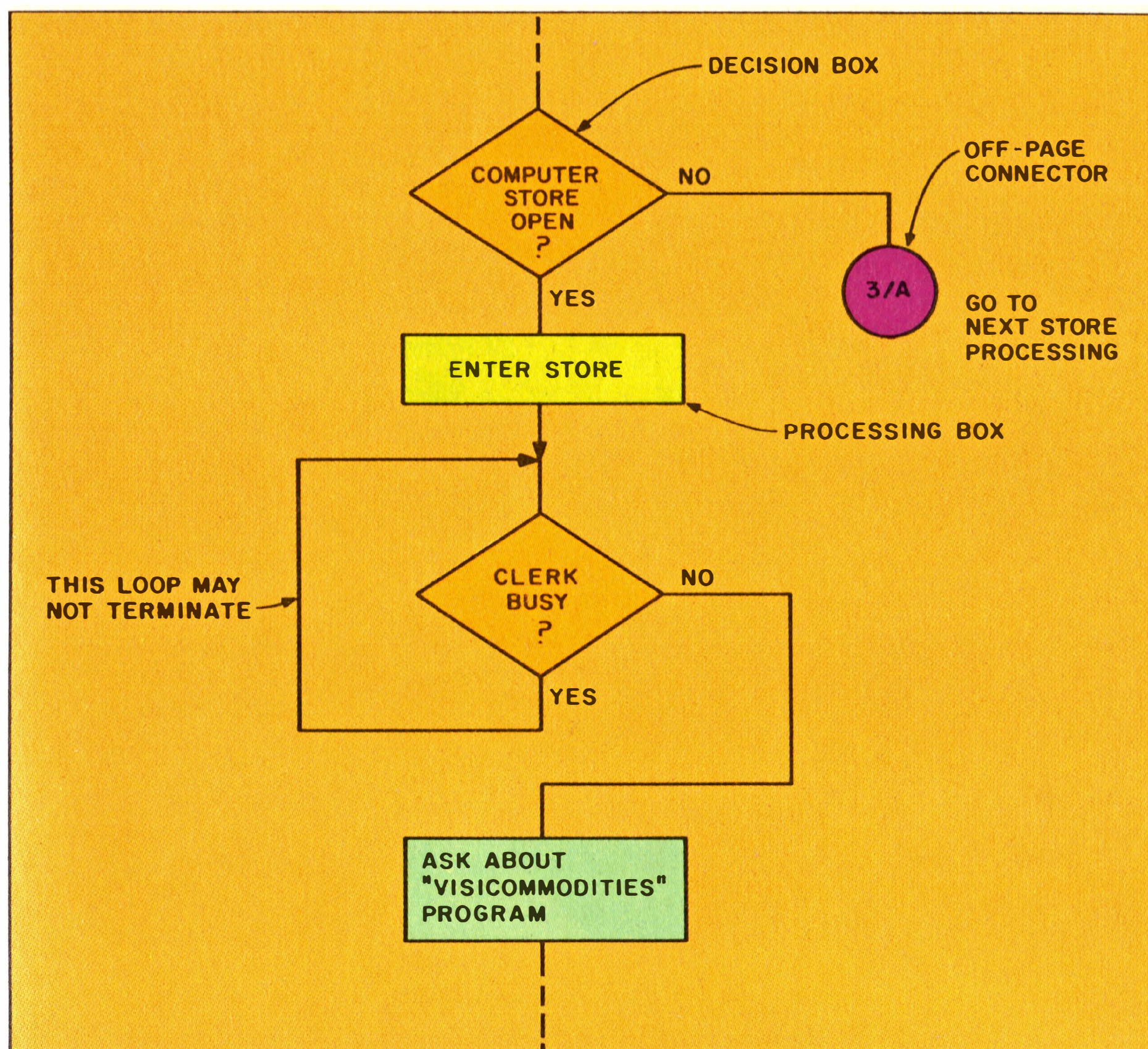


Figure 2: Flowcharts represent, in general terms, the major actions within a program. Beginning programmers can benefit from making such a chart.

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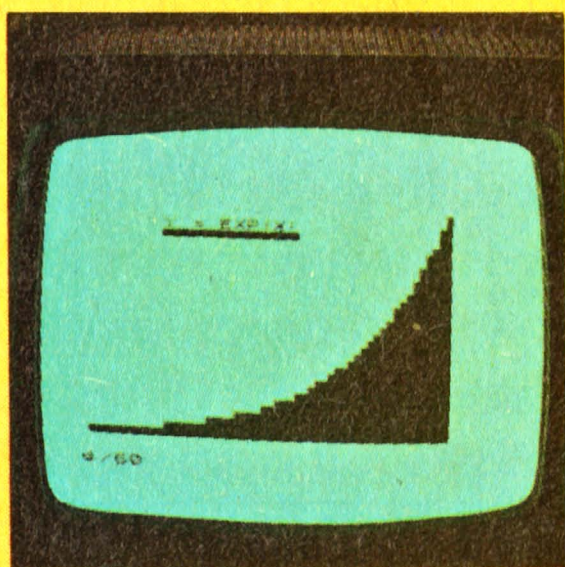
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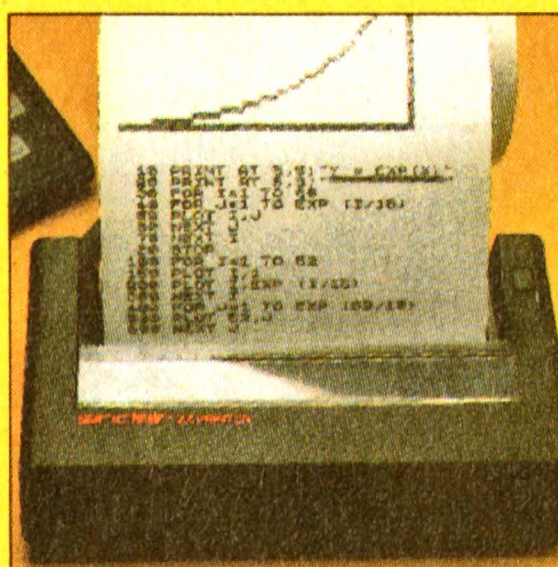
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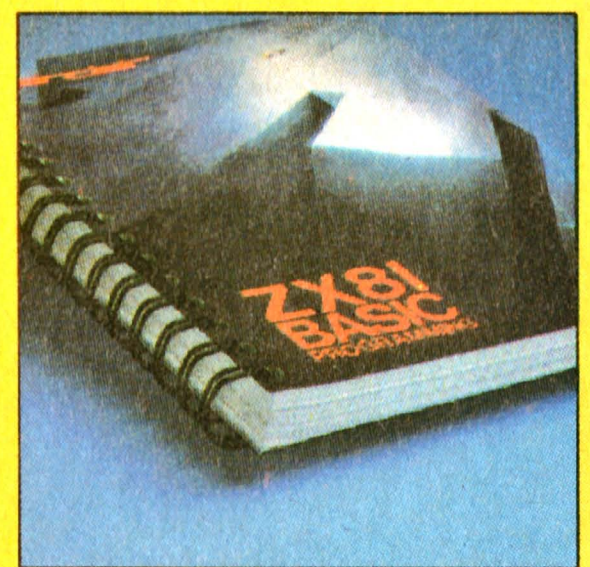
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Book Reviews

The Soul of a New Machine

Tracy Kidder

An Atlantic Monthly Press Book
Little, Brown and Company, 1981
293 pages, hardcover \$13.95
Reviewed by Rich Friedman

In recent years, technology has received bad press. Science, once considered the cure-all of societal ills, is now generally blamed for every malady from high-interest rates to the Medfly infestation in California.

phenomenon. Americans always worshipped machines, and every kid growing up in small-town USA could break down a car and put it back together in less than a day. Technology was the hope of the future.

The tide started turning when America's pride in its technological accomplishments was at its highest—the occasion of the Apollo moon shot. Chronicling the event in his book *Of a Fire on the Moon*, Norman Mailer described the puzzled reaction of thousands of Americans who had driven their campers to Cape Kennedy to witness the historic event: "He will see a world begin where machines are king and he does not know whether to cry from pride or the all-out ache that he does not really comprehend the new machinery."

Mailer, trained as an engineer at Harvard, understood the complexity of modern technology, but he also knew it made far racier copy to play to the fears of the masses than to explain the scientific achievement that put a man on the moon. And according to Mailer, the people who built these marvelous new machines were a breed apart, an almost subhuman species that toiled away in windowless "electronics computeroid complexes."

Twelve years later, Tracy Kidder has written the book that Mailer couldn't or wouldn't write. *The Soul of a New Machine* tells the story of how some 30

young and energetic engineers built, in record time, a super minicomputer for Data General Corporation.

Tom West, project director of Data General's new 32-bit computer, code-named Eagle, agreed to let Kidder observe the daily (and nocturnal) comings and goings of the Eagle team of engineers. Data General promised not to censor Kidder's manuscript and Kidder, in return, promised not to divulge any trade secrets.

Kidder lived with the engineers for two and a half years. His book is about people first and computers second. It's about people who started rebuilding television sets at age five; about people who think in nanoseconds when the rest of mankind measures time in days and months. It's a book that brings high technology down to a human, measurable scale.

Kidder first started in political science at Harvard and then switched his major to English. In an interview with the trade publication *Computerworld*, Kidder said: "I took a course from Henry Kissinger and it bored my socks off, so I quit. In a sense, though, I regret changing to English. I had never taken physics or math. Later I said to myself, look there are ways of understanding these things, they are important and I am going to do it. So I began writing articles on scientific topics and in the process I learned a few things."

What Kidder learned was how to become a good storyteller and how to translate scientific jargon into succinct, compelling prose. Take, for example, his definition of transistors: "... a family of devices (that) alter and control the flow of electricity in circuits Other devices then in existence could do the same work, but transistors are superior. They are solid. They have no cogs and wheels, no separate pieces to be soldered together; it is as if *they are stones performing useful work*" (my italics).

The Soul of a New Machine tells how the Microkids (those engineers who

worked on the Eagle's internal software) and the Hardy Boys (who designed the hardware) "signed on" to a project that required working 80-hour weeks (without extra pay, of course) in tiny windowless cubicles lacking privacy and quiet, where in the summer the temperature reached 88 degrees. For the new recruits it meant quickly mastering a virtual encyclopedia of technical detail. The project required a dedication that excluded family and friends, racing against self-imposed and corporate deadlines, and near-constant uncertainty—would the machine "ever get out the door"?

It also meant surrendering individual identity to the project and, upon its fruition, suffering a phenomenal postpartum depression. It meant endless debugging sessions and trying to produce a state-of-the-art design that was constantly compromised by corporate bottom-line realities.

The rewards were psychic, not financial. For a young engineer, it was a chance to work on an important project. There were no stock options, or even, in most cases, patents for original work. The name of the game, as West put it, was "pinball." "You win one game, you get to play another. You win with this machine, you get to build the next."

Some couldn't take the pressure. After spending months agonizing over a billionth-of-a-second timing unit in the computer, Josh Rosen, a 24-year-old electronics genius from Chicago, disappeared from work one day, leaving a message that he was going to a Vermont commune where he would "deal with no unit of time shorter than a season."

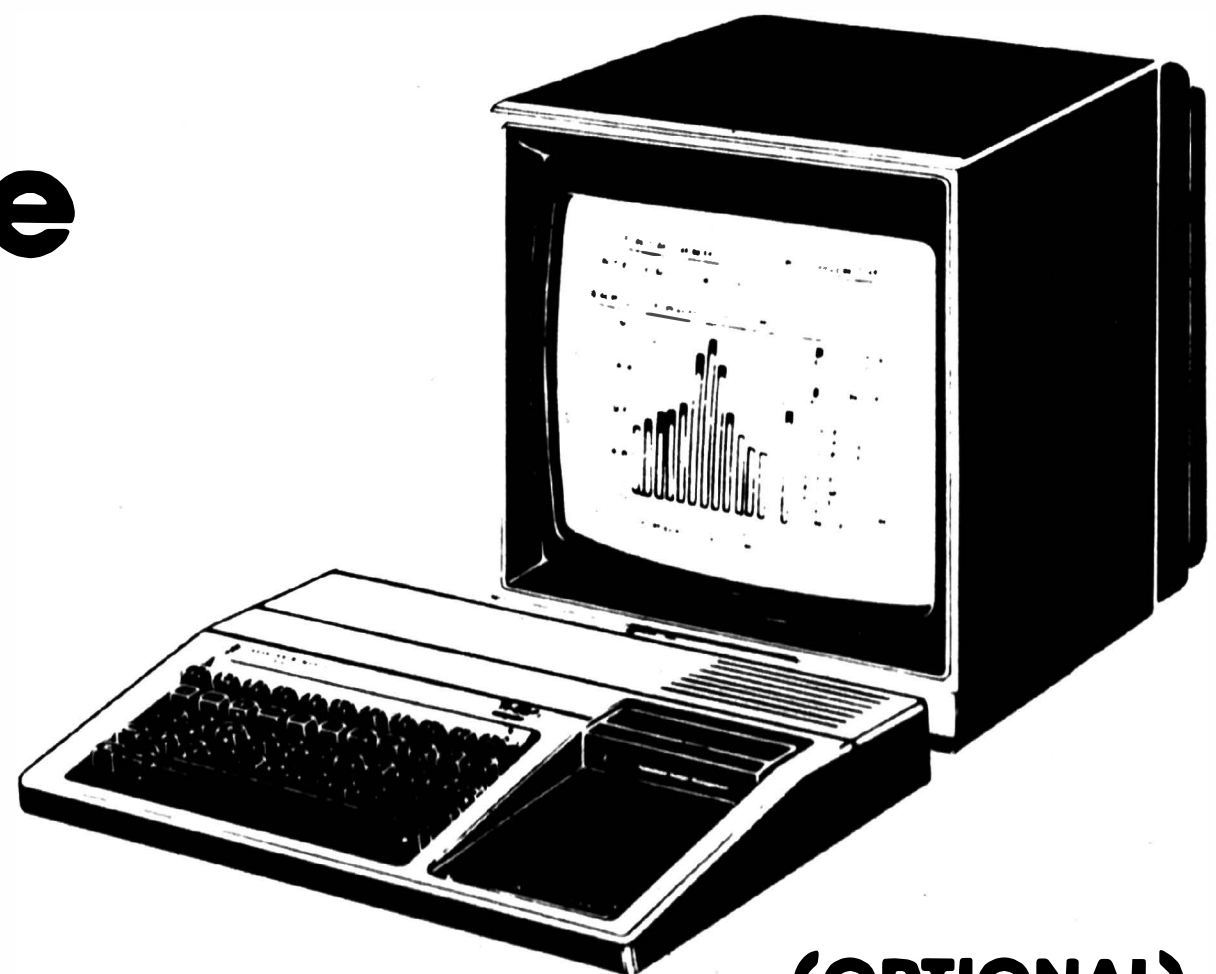
At times, Kidder digresses from his main story and writes about the impact computers have had on our society. He does not treat computers kindly. Kidder quotes Daniel Bell's assertion that the railroads have made far larger changes in the "lives of individuals"

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PHP	1700 RS-232 Accessories Interface	224.95	185.00
PHP	1800 Disk Drive Controller (One Disk Manager module packet with each Disk Controller)	299.95	238.00
PHP	1850 Disk Memory Drive	499.95	395.00
PHP	1900 Solid State Printer	399.95	318.00
PHP	2200 Memory Expansion (32K RAM)	399.95	318.00
PHA	2100 R.F. Modulator (TV Adapter)	49.95	40.00
PHA	4100 10" Color Monitor*	374.95	330.00
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Cassette			
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11 Developed by Scott Foresman

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than computers have. West, going one better, said that "bulldozers have had a hell of a lot bigger effect." Kidder classifies computers as "handy greed-extendors," adding "they make fine tools for the centralization of power, if that's what those who buy them want to do with them."

Kidder feels that computers did not create an information "revolution"—the mass media wrongly created that

label. "In many cases," Kidder wrote, "(computer) technology had served as a prop to the status quo."

But Kidder does acknowledge that computers have made a difference. "They have fostered the development of spaceships—as well as a great increase in junk mail. The computer boom has brought the marvelous but expensive diagnostic device known as the CAT scanner, as well as a host of

other medical equipment; it has given rise to machines that play good but rather boring chess, and also, on a larger game board, to a proliferation of remote-controlled weapons in the arsenals of nations And computers have become a part of the ordinary conduct of businesses of all sorts. They really help, in some cases.

"Not always, though. One student of the field has estimated that about forty percent of commercial applications of computers have proved uneconomical, in the sense that the job the computer was bought to perform winds up costing more to do after the computer's arrival than it did before."

In sum, Kidder's observant eye and overall objectivity are what make *The Soul of a New Machine* such a good book. In the end, Eagle did get "out the door" (the Data General marketing folks officially christened it the Eclipse MV/8000) and its success contributed substantially to Data General's overall profits. But for the Microkids and Hardy Boys what was important was the "feeling of accomplishment," the "self-satisfaction." One engineer, Jim Guyer, put it this way: "Ninety-eight percent of the thrill comes from knowing that the thing you designed works, and works almost the way you expected it would. If that happens, part of you is in that machine."

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Build Your Own Z80 Computer

Steve Ciarcia

Byte Books/McGraw-Hill, 1981

332 pages, softcover \$15.95

Reviewed by John Edwards

For those not familiar with the saga of microcomputers, first, a short history lesson. About five or six years ago, the only way you could get started in microcomputing was by building a computer yourself—usually from a kit. Back in those innocent days it was easy to tell the hobbyist from the profes-

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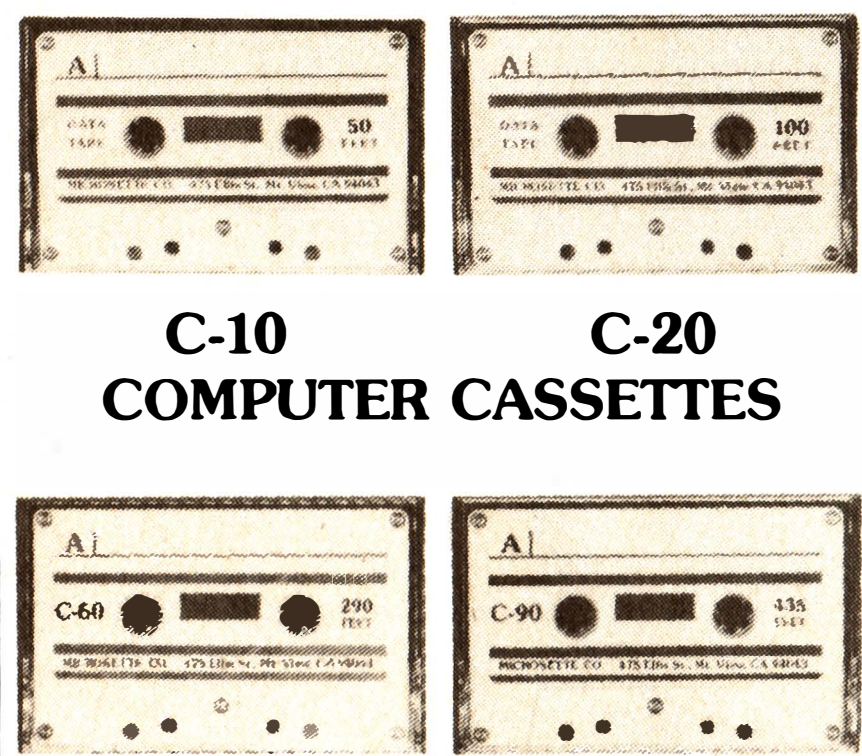
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Book Reviews

sional just by looking for solder burns. As time advanced, microcomputers began to interest the nontechnician. Almost overnight, one could walk into a neighborhood computer store and buy a working micro for less money than a kit had cost. A new era had arrived, but not without a certain loss.

Today, your average microcomputerist looks upon a soldering iron with a mixture of curiosity and amazement. (Hey, what's that? An electric cigar?) But some of us still yearn for the good old days when solder smoke hung thickly over the workbench and technical discovery was a heady intoxicant.

Along comes a book that's a throwback to those times when computer hobbyists were as familiar with a prototype board as a flowchart. A book, in 1981, that encourages you to build your own computer. *Build!* The word unleashes a flood of nostalgia.

Build Your Own Z80 Computer, the book is titled, and in it Steve Ciarcia proves that the computer experimenter spirit is not dead. Best of all, he does it in a way that's fascinating to beginning and advanced computerists alike.

Actually, building a microcomputer from scratch isn't as formidable a task as it may sound—at least not the way Ciarcia explains it. Using a building-block approach, he takes us from the construction of the power supply (easy stuff first), up through the basics of the Z80 microprocessor, and introduces us to all manner of peripherals. The book even explains how to “homebrew” a CRT terminal.

Many present-day computer hobbyists are more adept at paperwork than building work. Taking that into account, Ciarcia carefully details proper construction techniques and literally guides the reader by the hand through each step. But this is more than a “how-to” book. Ciarcia carries us beyond construction and testing procedures, and into the world of computer theory and design. By the time you've finished building your micro, you not only have a working computer (at a discount price), but a solid fundamental knowledge of why it works.

All in all, it's a great book—even for us mossbacks who've been through it all before.

The Community Computerist's Directory “The Who's Who of People and Computers”

Alternet, Inc.,
74 pages, softcover \$3.50
Reviewed by Rachael Wrege

The Community Computerist's Directory's motto is “Let Your Fingers Do the Talking.” And rightly so—with this handy little guide in your back pocket, your fleshy digits will be able to gab on and on.

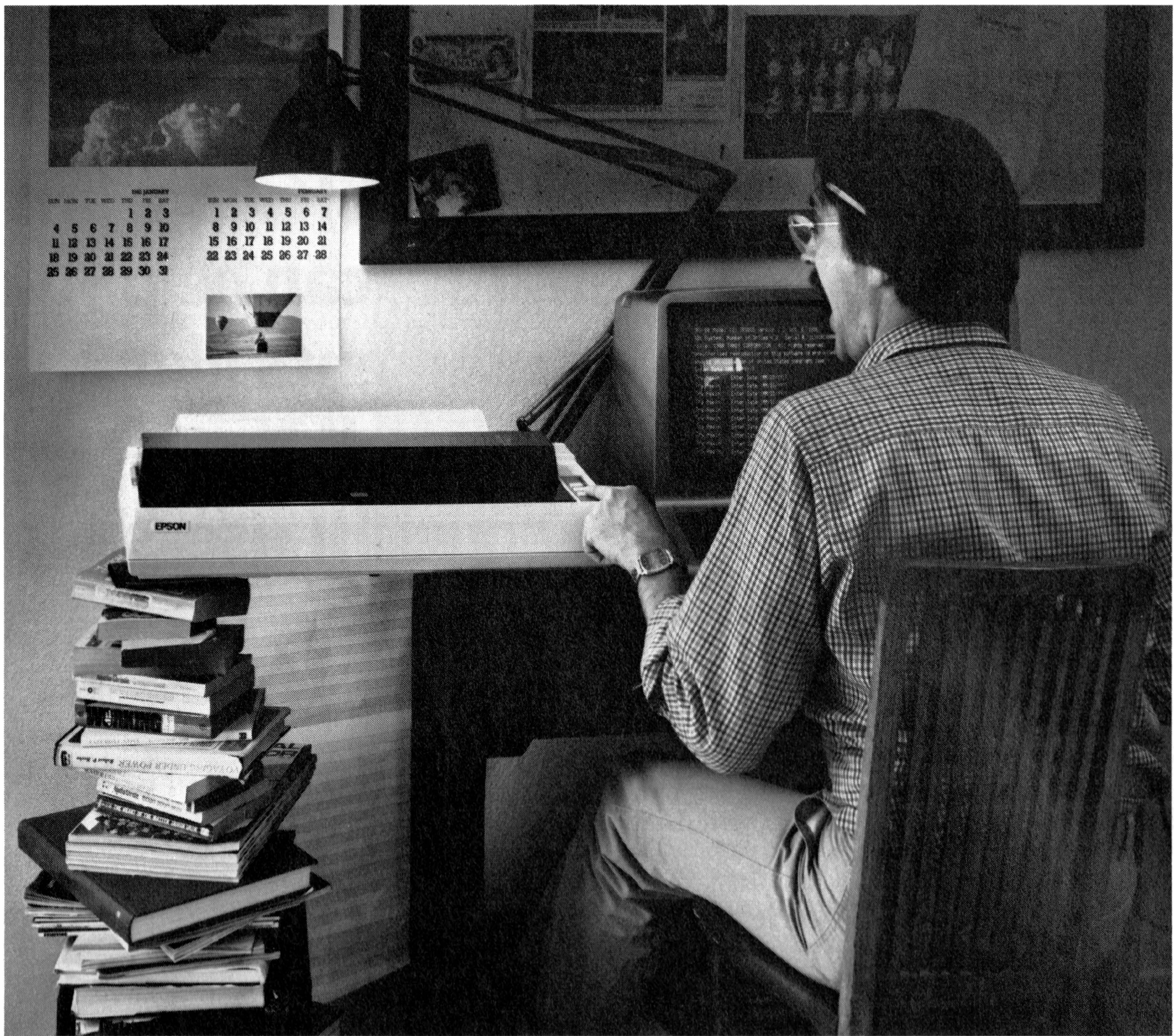
The directory is an information-packed “telephone” book of club, organization, association, user-group, and bulletin-board listings. The “white pages” include personal ads from individual computer hobbyists, experts, and novices interested in sharing information, ideas, and equipment. The “yellow pages” offer advertisements for everything from modems and speech synthesizers to light pens and other directories.

While the directory is clever and fun to flip through, the most entertaining listings are such personal ads as:

48 K CPU, Z80, would like to meet APPLE with interest in loving relationship. I have double density, dual floppies. Willing to pay for Z80 card for right APPLE. Let's test compatibility and prove to the world mixed relationships can work. No smokers or game addicts please.

The semiannual directory promises to grow as more and more computer buffs discover and use it. Subscriptions are available and include free personal listings. The U.S. and Canada are among the geographical areas covered, and the entire book is indexed, with a substantial glossary tossed in for easy understanding.

The directory is available from CCD, POB 405, Forestville, CA 95436. ☐



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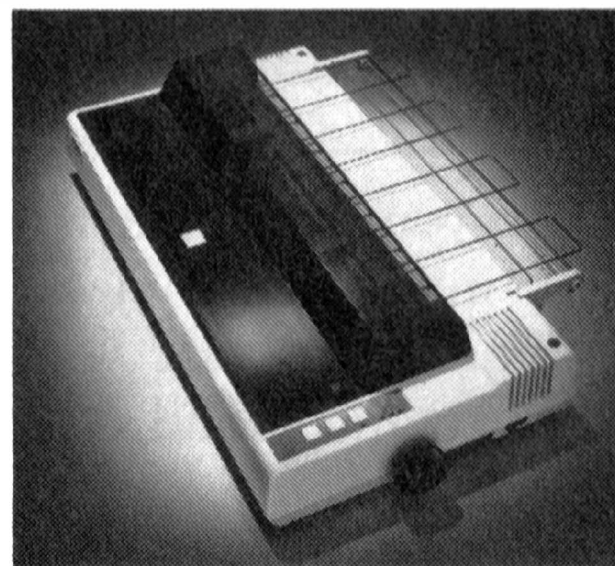
The MX-100 is a printer that must be seen to be believed. For starters, we built in unmatched correspondence quality printing, and an ultra-high resolution bit image graphics capability. Then we added the ability to print up to 233 columns of information on 15" wide paper to give you the most incredible spread sheets you're ever likely to see. Finally, we topped it all off with *both* a satin-smooth friction feed platen *and* fully adjustable, removable tractors. And the list of standard features goes on and on and on.

Needless to say, the specs on this machine — and especially at under \$1000 — are practically unbelievable. But there's something about the MX-100 that goes far

beyond just the specs; something about the way it all comes together, the attention to detail, the fit, the feel. Mere words fail us. But when you see an MX-100, you'll know what we mean.

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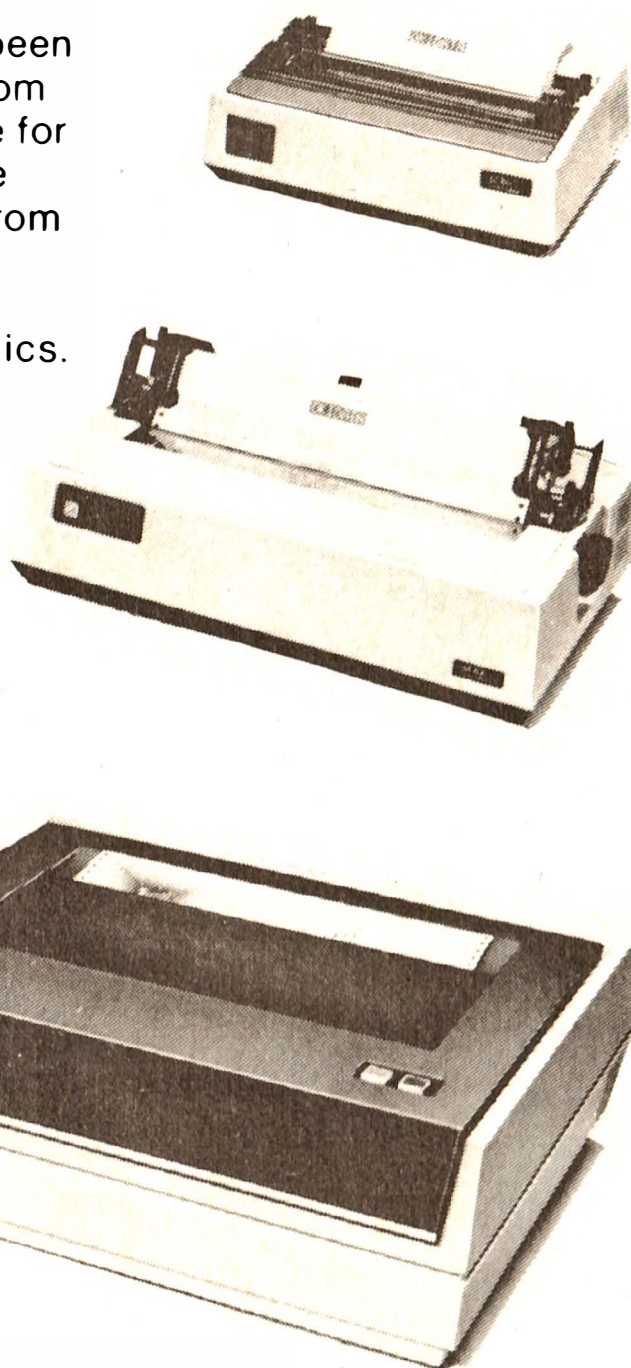
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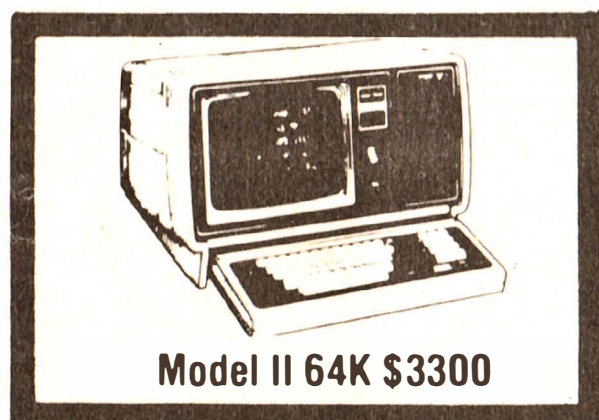


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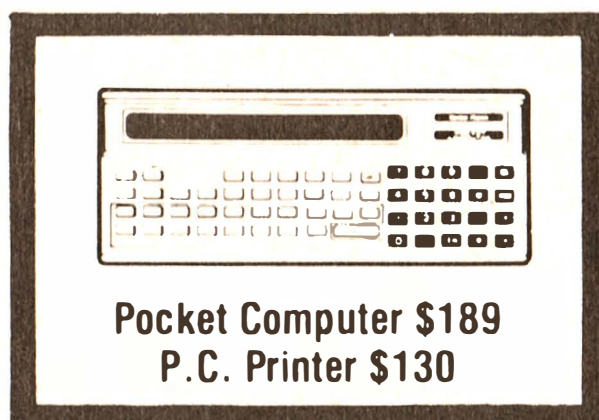
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*Corresponding directly with company
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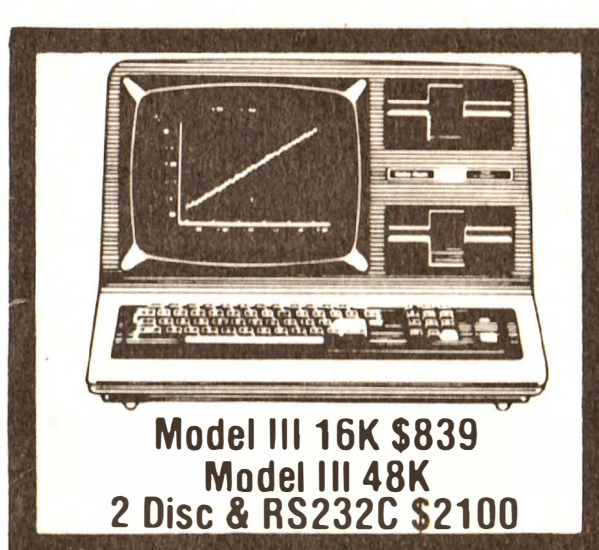
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2 Disc & RS232C \$2100

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- ☐ Sales Projection and Analysis
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- ☐ R&D Project Evaluation
- ☐ Energy Accounting
- ☐ Cost Estimating
- ☐ Consolidations
- ☐ Tax Planning

One version of PLAN80, distributed by Apple Computer, Inc., is available from your Apple dealer.

Suggested retail price of the CP/M version, \$295. Manual alone, \$30. Dealer and Distributor Inquiries Invited.

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New Products



Your Personal Attache

The Attache by Otrona is an 18-pound microcomputer that features a Z80A microprocessor, a 5-inch video display, two 180 K-byte floppy-disk drives, a standard keyboard that flips down, and 64 K bytes of programmable memory. A second microprocessor takes care of the disk drives and two serial ports. Standard software supplied is CP/M, an enhanced WordStar word-processing program, and extended BASIC. The UCSD Pascal language system is also available, and any programs written for the CP/M operating system or UCSD Pascal can be run on the Attache.

Options include graphics, DC or battery operation, and a multifunction board with a general-purpose interface. Contact Otrona Corp., 2500 Central Ave., Boulder, CO 80301, (303) 444-2274.

Circle 201 on inquiry card.

CP/M Capability with the Model III

The Freedom 3 is a modification that adds CP/M operating system capability to the TRS-80 Model III. It includes extra memory and a battery backed calendar and clock. Compatible with TRSDOS and other operating systems, the Freedom 3 changes the way the Model III works so that it can accept programs written for the CP/M operating system. The device simply plugs into the Model III.

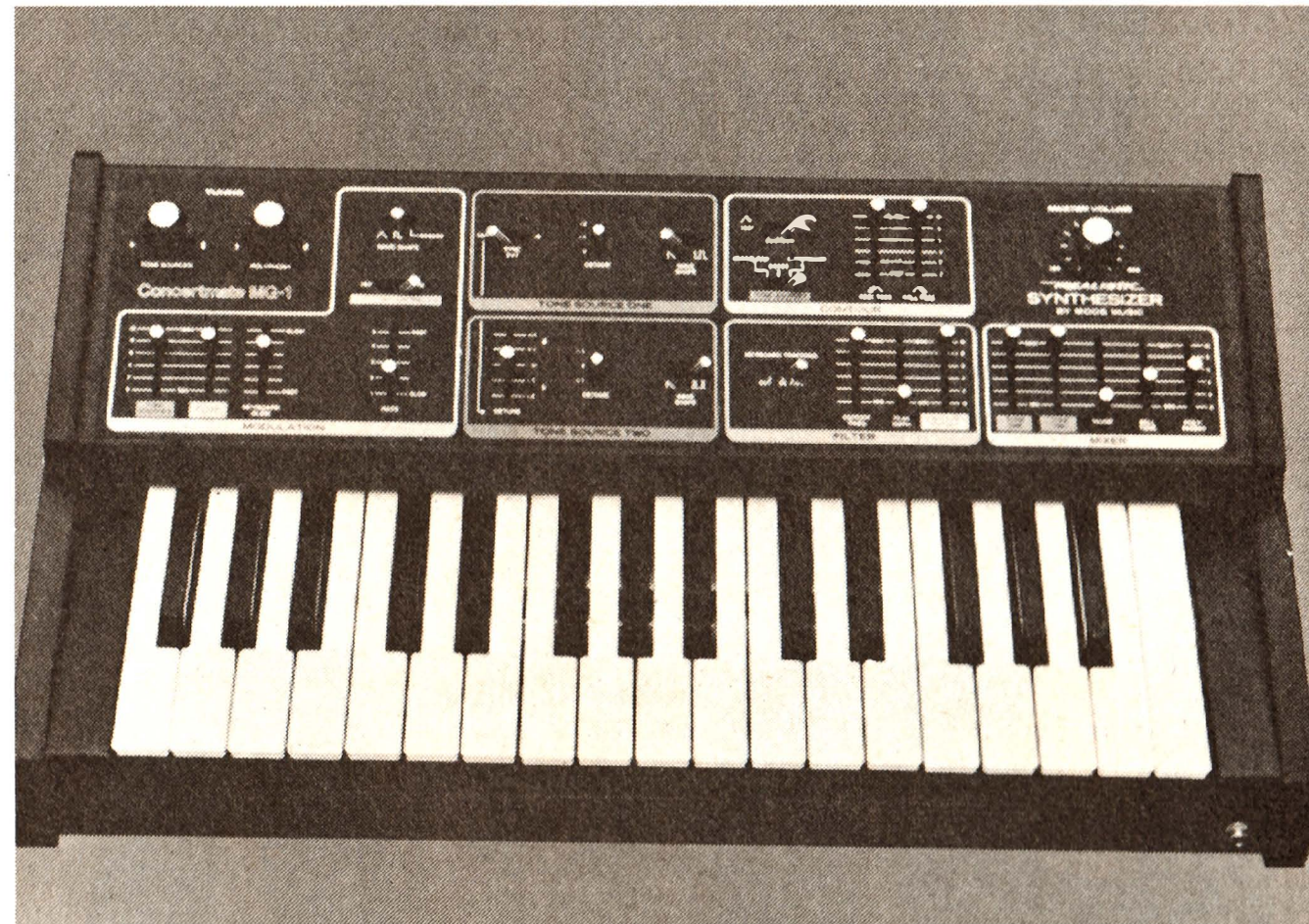
The basic Freedom 3 system is the Model 3A. It doesn't have memory, but it comes with the operating system for CP/M. The Model 3A costs \$199. The Freedom 3B has 40 K bytes of RAM and the operating system. It costs \$340. The Freedom 3C includes the memory, calendar and clock, and the operating system for \$490. For information, contact Field Engineering Consultants, Ltd., POB 2368, Woburn, MA 01888, (617) 944-5329.

Circle 202 on inquiry card.

The Coloring Board

Coloring Board, a color graphics program for the Apple II, costs \$60 and allows users to create, erase and change, store, and retrieve graphics employing both drawings and alphanumerics. A high-resolution program, it offers six colors, automatic generation of arcs, circles, squares, rectangles, ellipses, triangles, other shapes, maps of the US and the world, and a space-launch graphic. For more information, contact Software Technology for Computers, POB 428, Belmont, MA 02178, (617) 923-4334.

Circle 203 on inquiry card.



Music Synthesizer from Radio Shack

Synthesizers are electronic devices capable of duplicating the sounds and intonation of many traditional musical instruments as well as creating sounds unlike any common instrument. The Realistic MG-1 Synthesizer by Moog can recreate the sounds of a variety of musical instruments plus create a multitude of special effects. The unit is polyphonic, so it can play whole chords or single notes. MG-1 features a 2½-octave full-chromatic keyboard and includes two three-octave tone sources, a mixer, a

modulator, filters, and contour controls. The synthesizer can be played through an amplifier or listened to through headphones.

The Realistic MG-1 runs on AC power and is provided with a tutorial-style manual with sample control settings for unique sounds. It is available for \$499.95 at Radio Shack stores and participating dealers. Contact Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102, (817) 390-3272.

Circle 204 on inquiry card.

A "Jukebox" for Personal Computers

Amlyn Corporation has designed a family of 5¼-inch floppy-disk drives that use a five-disk cartridge to provide up to 8 megabytes of data storage. The disk cartridge holds five special 5¼-inch floppy disks and is designed to allow users to easily change an entire cartridge at a time or individual disks within it. Two models are available that will work with nearly all personal computers using standard 5¼-inch floppy-disk drives. Both models use built-in micropro-

cessors to handle control functions. Typical capacities are 4 megabytes per cartridge with 800 K bytes per disk in single-density recording and 8 megabytes per cartridge, 1600 K bytes per disk in the double-density mode.

The Amlyn drives are designed to fit in the space required by ordinary 5¼-inch drives. The drives cost around \$1250. Contact Amlyn Corp., 1758-H Junction Ave., San Jose, CA 95112, (408) 275-8616.

Circle 205 on inquiry card.

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1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNU1	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQOQ	Fixed quantity economic order quantity model

NAME

DESCRIPTION

53	FQEOWSH	As above but with shortages permitted
54	FQEQQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project

Circle 38 on Inquiry card.

59	WACC	Weighted average cost of capital
60	COMBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCONVB	Investor's rate of return on convertible bond
100	PORTVAL9	Stock market portfolio storage-valuation program

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C.C. Writer

C.C. Writer is a word processor designed for the TRS-80 Color Computer with Extended BASIC and 16 K bytes of RAM. Margins, line spacing, justification, paragraph indentation, and page pause for

single-sheet feeding can be controlled by the user as well as line skipping, new paragraphs, centered text, tabs, and indentation of both margins. C.C. Writer can handle the latest "smart" printers, create print graphics, and insert, delete, or modify anything in the text. The 16 K version will hold 4000 characters in memory, and the 32 K option will hold 19,000 characters. Files can be chained together for automatic loading and printing by the program.

C.C. Writer is available for \$30 from Transformation Technologies, 194 Lockwood Ln., Bloomingdale, IL 60108. Circle 207 on inquiry card.

Disk Drives for the TRS-80 Color Computer

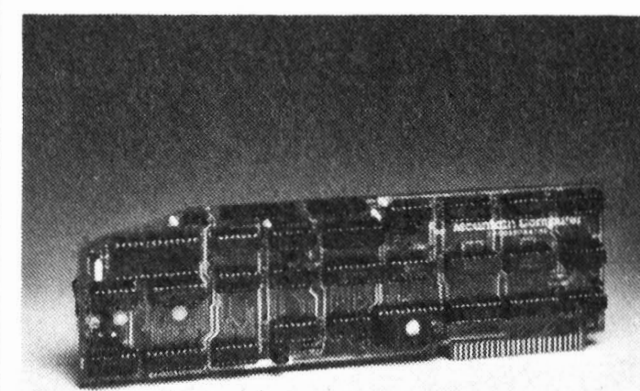
Tallgrass Technologies has a floppy-disk interface for the TRS-80 Color Computer that

allows the use of double-density format on standard 5¼-inch drives. With double-sided, 96-track-per-inch drives, the storage capacity is 816 K bytes per drive. An EPROM (erasable programmable read-only memory) containing the disk-interface software is available for \$34.95. The EPROM includes FLEA, a set of commands for debugging assembly- and machine-language programs. The price for the interface is \$99.95. Contact Tallgrass Technologies Corp., POB 12047, 9009 W. 95th St., Overland Park, KS 66212, (913) 381-5588.

Circle 208 on inquiry card.

More for Your Apple

Mountain Computer has a new and versatile circuit board that broadens the horizons (and capabilities) of your Apple II personal computer. The CPS MultiFunction board provides a serial interface (for con-



necting certain printers, modems, etc.), a parallel interface (for certain types of printers and other accessories), and a real-time calendar/clock. A special feature of the board is the ability to use the serial and parallel interfaces at the same time and the ability to assign functions from the board to certain slots without the board physically being there. The board also has its own battery that keeps the clock/calendar correct for up to two years—even when the computer is turned off! CPS is priced at \$239 and is available from Mountain Computer, Inc., 300 El Pueblo Rd., Scotts Valley, CA 95066.

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SBC-200, 64K ExpandoRAM II, Versafloppy II, CP/M 2.2

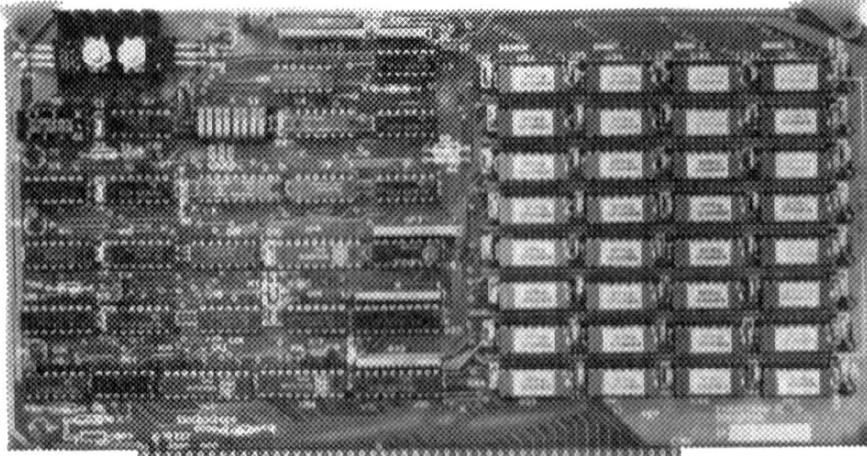
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4 MHz Z-80A CPU, 64K RAM, serial I/O port, parallel I/O port, double-density disk controller, CP/M 2.2 disk and manuals, system monitor, control and diagnostic software.

-All boards are assembled and tested-

ExpandoRAM III

64K to 256K expandable RAM board



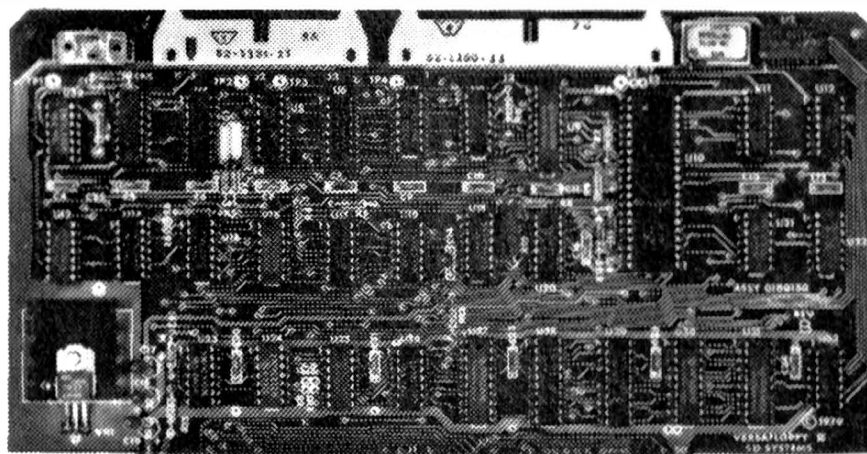
SD Systems has duplicated the famous reliability of their ExpandoRAM I and II boards in the new ExpandoRAM III, a board capable of containing 256K of high speed RAM. Utilizing the new 64K x 1 dynamic RAM chips, you can configure a memory of 64K, 128K, 192K, or 256K, all on one S-100 board. Memory address decoding is done by a programmed bipolar ROM so that the memory map may be dip-switch configured to work with either COSMOS/MPM-type systems or with OASIS-type systems.

Extensive application notes concerning how to operate the ExpandoRAM III with Cromemco, Intersystems, and other popular 4 MHz Z-80 systems are contained in the manual.

MEM-65064A	64K A & T		\$495.00
MEM-65128A	128K A & T		\$639.95
MEM-65192A	192K A & T		\$769.95
MEM-65256A	256K A & T		\$879.95

Versafloppy II

Double density controller with CP/M 2.2



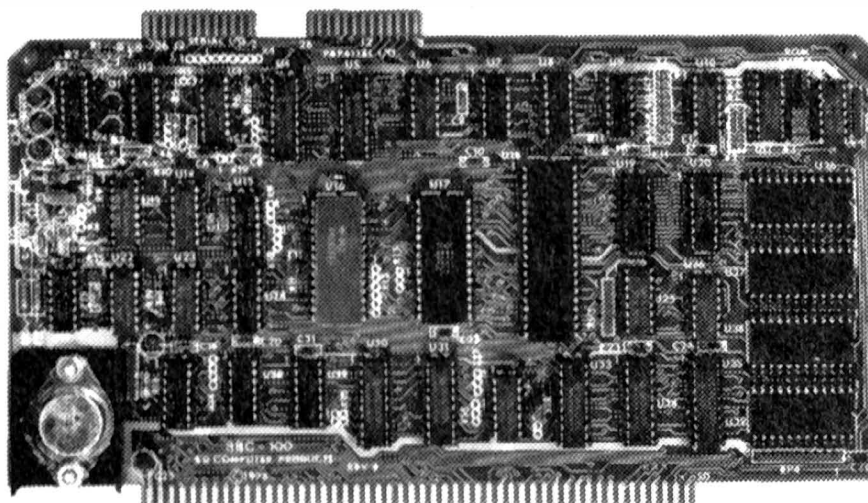
- S-100 bus compatible • IBM 3740 compatible soft sector format • Controls single and double-sided drives, single or double density, 5 1/4" and 8" drives in any combination of four simultaneously
- Drive select and side select circuitry • Analog phase-locked loop data separator • Vectored interrupt operation optional • CP/M 2.2 disk and manual set included • Control/diagnostic software PROM included

The Versafloppy II is faster, more stable and more tolerant of bit shift and "jitter" than most controllers. CP/M 2.2 and all necessary control and diagnostic software are included.

IOD-1160A A & T with CP/M 2.2 .. \$370.00

SBC-200

2 or 4 MHz single board computer



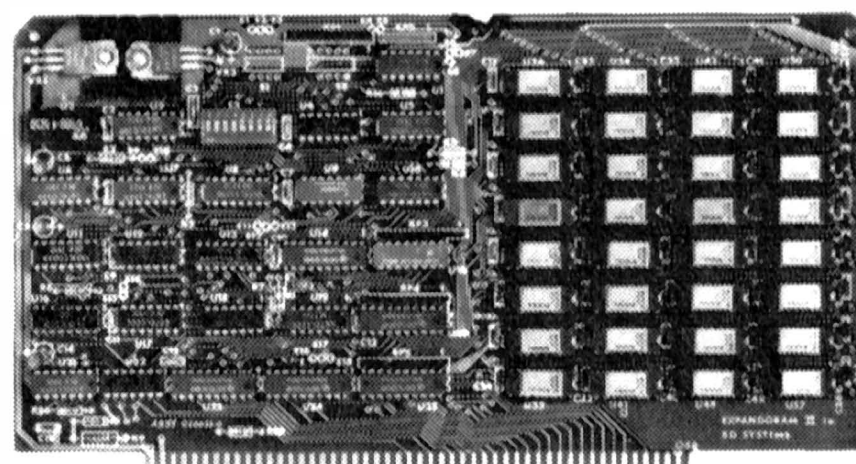
- S-100 bus compatible • Powerful 4MHz Z-80A CPU • Synchronous/asynchronous serial I/O port with RS-232 interface and software programmable baud rates up to 9600 baud • Parallel input and parallel output port • Four channel counter/timer • Four maskable, vectored interrupt inputs and a non-maskable interrupt • 1K of on-board RAM • Up to 32K of on-board ROM • System monitor PROM included

The SBC-200 is an excellent CPU board to base a microcomputer system around. With on-board RAM, ROM, and I/O, the SBC-200 allows you to build a powerful three-board system that has the same features found in most five-board microcomputers. The SBC-200 is compatible with both single-user and multi-user systems.

CPU-30200A A & T with monitor \$299.95

ExpandoRAM II

16K to 64K expandable RAM board



- S-100 bus compatible • Up to 4MHz operation • Expandable from 16K to 64K • Uses 16 x 1 4116 memory chips • Page mode operation allows up to 8 memory boards on the bus • Phantom output disable • Invisible on-board refresh

The ExpandoRAM II is compatible with most S-100 CPUs. When other SD System' series II boards are combined with the ExpandoRAM II, they create a microcomputer system with exceptional capabilities and features.

MEM-16630A	16K A & T		\$325.00
MEM-32631A	32K A & T		\$345.00
MEM-48632A	48K A & T		\$365.00
MEM-64633A	64K A & T		\$385.00

COSMOS

Multi-user operating system

- Multi-user disk operating system • Allows up to 8 users to run independent jobs concurrently • Each user has a separate file directory

COSMOS supports all the file structures of CP/M 2.2, and is compatible at the applications program level with CP/M 2.2, so that most programs written to run under CP/M 2.2 or SDOS will also run under COSMOS.

SFC-55009039F COSMOS on 8" disk \$395.00

Multi-User System

SBC-200, 256K ExpandoRAM III, Versafloppy II, MPC-4 COSMOS Multi-User Operating System, C BASIC II

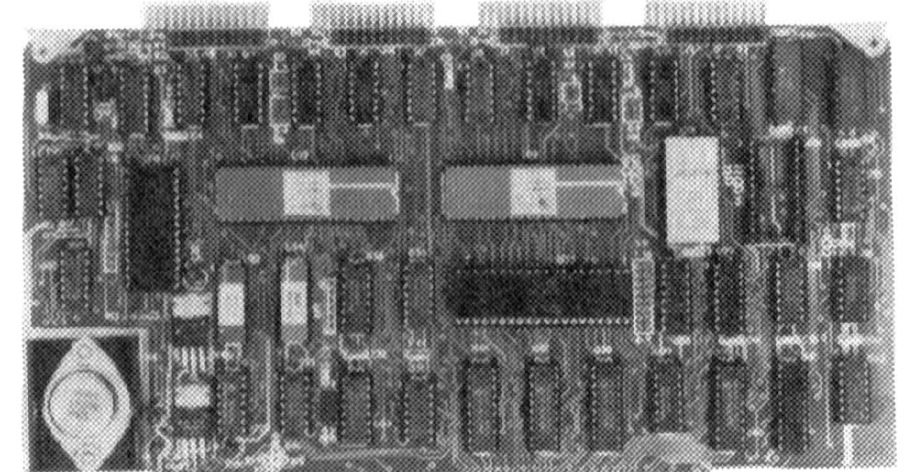
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Two Z-80A CPUs (4 MHz), 256K RAM, 5 serial I/O ports with independently programmable baud rates and vectored interrupts, parallel input port, parallel output port, 8 counter/timer channels, real time clock, single and double sided/single or double density disk controller for 5 1/4" and 8" drives, up to 36K of on-board ROM, CP/M 2.2 compatible COSMOS interrupt driven multi-user disk operating system, allows up to 8 users to run independent jobs concurrently, C BASIC II, control and diagnostic software in PROM included.

-All boards are assembled and tested-

MPC-4

Intelligent communications interface



- Four buffered serial I/O ports • On-board Z-80A processor • Four CTC channels • Independently programmable baud rates • Vectored interrupt capability • Up to 4K of on-board PROM • Up to 2K of on-board RAM • On-board firmware

This is not just another four-port serial I/O board! The on-board processor and firmware provide sufficient intelligence to allow the MPC-4 to handle time consuming I/O tasks, rather than loading down your CPU. To increase overall efficiency, each serial channel has an 80 character input buffer and a 128 character output buffer. The on-board firmware can be modified to make the board SDLC or BISYNC compatible. In combination with SD's COSMOS operating system (which is included with the MPC-4), this board makes a perfect building block for a multi-user system.

IOI-1504A A & T with COSMOS .. \$495.00

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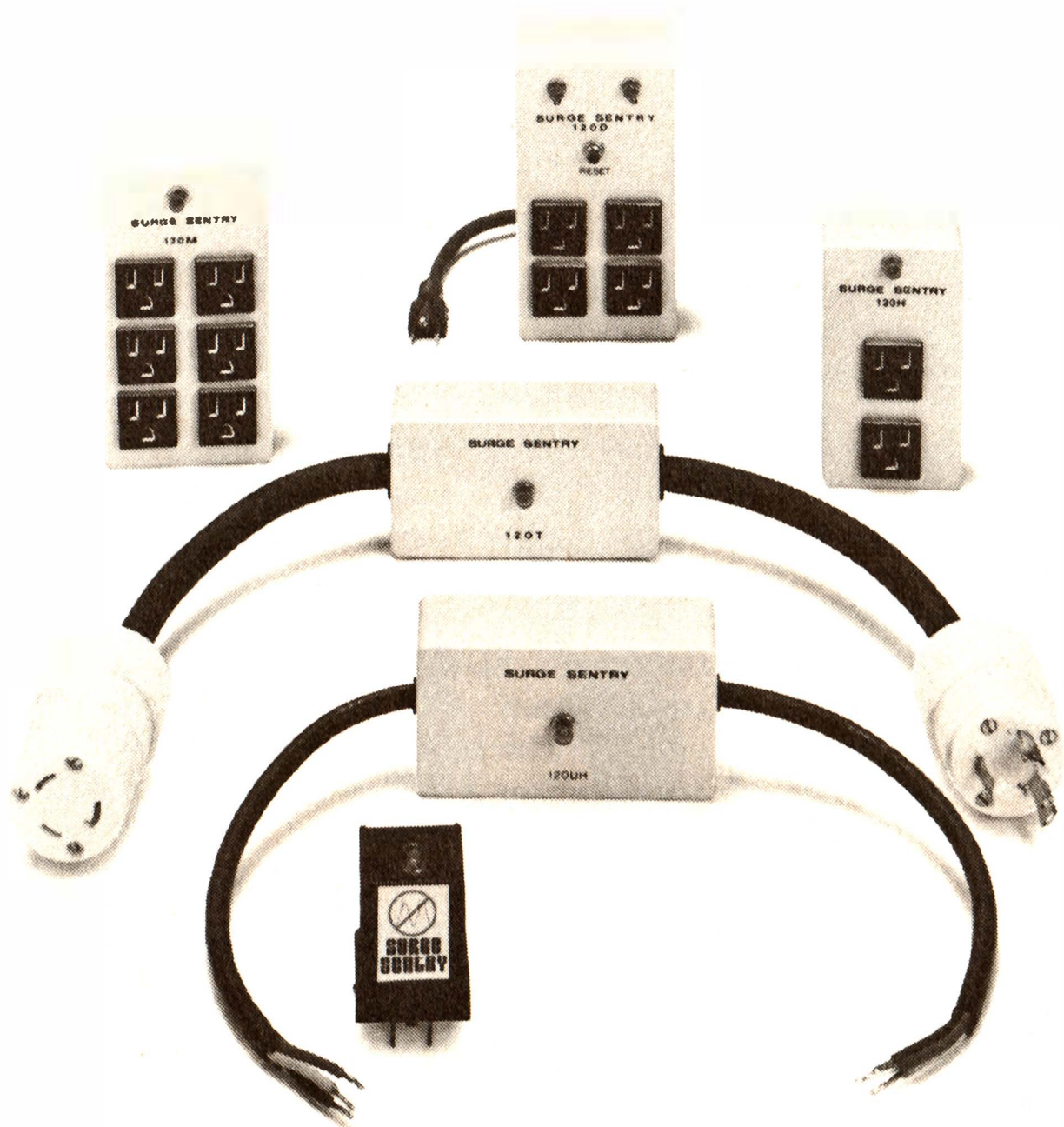
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New Products

WordStar and Magic Wand for Heath/Zenith

The popular WordStar and Magic Wand word-processing programs are now available for the Heath H-8, H-89, and Zenith Z-89 microcomputers. The WordStar program, priced at \$395, features simultaneous printing and editing, column alignment, and boldface, double strike, strikeout, subscript, overprint, and accent entry. It can also interrupt itself, execute another program, and return to itself.

Magic Wand's edit mode offers character or full insertion, search/replace commands, block move of text, and the ability to examine the disk directory without leaving EDIT. The program also supports proportional-space printing. It costs \$295. Both programs run under the Heath CP/M operating system. For more information, contact Heath Co., Benton Harbor, MI 49022, (616) 982-3210.

Circle 210 on inquiry card.

The PFS Software Series

PFS:REPORT is the latest addition to the PFS series of information-management tools for the Apple. PFS:REPORT produces presentation-quality formatted reports with headings, totals, averages, counts, and calculations. With PFS, which allows you to design a form on screen, and PFS:REPORT, nonprogrammer professionals can create database systems. PFS:REPORT uses the form created with PFS to indicate what information is to be listed in the report. Each program is \$95 from Software Publishing Corp., 2021 Landings Dr., Mountain View, CA 94043, (415) 368-7598.

Circle 211 on inquiry card.

Hook Your Apple to a Star

Decision Resources' Chart-Master program can hook your Apple to a star—a graphics star, that is. Combining the Apple II or III with a Hewlett-Packard plotter, Chart-Master lets you produce graphics in eight colors, create, edit, store, and plot bar, line, and pie graphs, and scatter diagrams, text pages, signs, and abstract graphics. Chart-Master also interfaces with VisiCalc to plot selected rows and columns from any VisiCalc model. Suggested retail price for Chart-Master is \$375 from Decision Resources, 44 White Birch Rd., Weston, CT 06883, (203) 222-1974.

Circle 212 on inquiry card.

Welcome to Today

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Circle 213 on inquiry card.

Apple-to-Videodisc Interface

Allen Communication has announced a videodisc interface for the Apple II microcomputer. The Video-Microcomputer Interface, or VMI, is a board that provides connections between the Apple II and DiscoVision Associates' industrial videodisc players, the Sony LDP-1000 player, or the Pioneer VP-1000 Laserdisc player. The interface is also

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The Logo language is now available for your Apple II Plus* microcomputer. For further information write to us or contact your local dealer.

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compatible with other players and can be used as an interface between the Apple and other peripherals. A parallel and two serial ports are built in to handle different kinds of players.

The VMI interface package includes the board, a cable connection that rests outside the Apple, software drivers in BASIC and Pascal, and a manual. The VMI carries a suggested list price of \$575. For additional details, contact Allen Communication, 3004 Arapahoe Ave., Boulder, CO 80303, (303) 449-2971.

Circle 214 on inquiry card.

More for the TRS-80 Color Computer

The CMEMORY cartridge for the TRS-80 Color Computer gives users an extra 8 K bytes of memory in the form of either RAM (random-access memory) or EPROM (erasable programmable read-only memory). It plugs directly into the cartridge slot of the Color Computer. The CMEMORY cartridge without any memory sells for \$24.95. Contact Micro-Labs, Inc., 902 Pinecrest, Richardson, TX 75080.

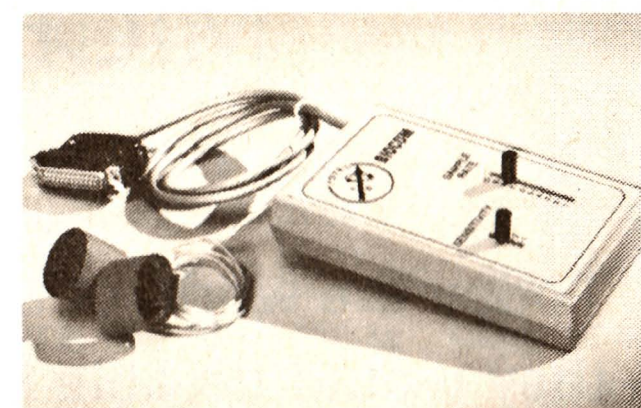
Circle 215 on inquiry card.

Beat the Tax Tribulations

Individual Tax Plan was designed specifically for professional tax practitioners. Automatic computations include federal tax liability, using appropriate tax tables and rate schedules, income averaging, and maximum tax on earned income, with selection of the lowest tax due; add-on minimum and alternative minimum tax; 10-year averaging for lump-sum distributions; charitable contribution, medical expense, and capital-loss limitations; and capital-gain deductions. Individual Tax Plan is available for the Apple II with

48 K bytes of memory or the Western Digital Microengine. Contact Aardvark Software, Inc., 783 N. Water St., Milwaukee, WI 53202, (414) 289-9988.

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Extend Your Senses

Relax and indulge your senses with the Biocom, a biofeedback computer program created by Total Digital Engineering. Biocom measures your emotional state and gives biofeedback through the computer's display screen. Supplied software programs teach controlled relaxation techniques, test subliminal response, and let you play Computer Ouija. Biocom connects through an RS-232C port, retails for \$125, and is available from Total Digital Engineering, 210 Daniel Webster Highway, Nashua, NH 03060, (603) 883-0991.

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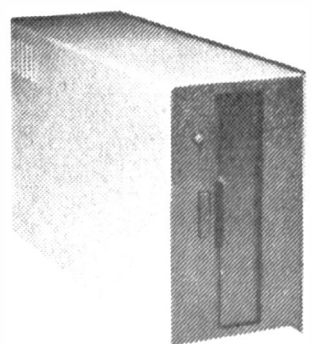
Z80 Card for Heath H-8 Microcomputers

The HA-8-6 Z80 circuit board uses a Z80 microprocessor and is designed to replace the 8080A supplied with the Heathkit H-8. The card is compatible with all current Heath-disk-based software for the H-8 and runs faster than the 8080A. Using this circuit, H-8 owners can add the Heath CP/M operating system or the Heath H-47 8-inch floppy-disk drive. The \$199 HA-8-6 Z80 card completely assembled and tested is available from Heath Co., Benton Harbor, MI 49022, (616) 982-3210.

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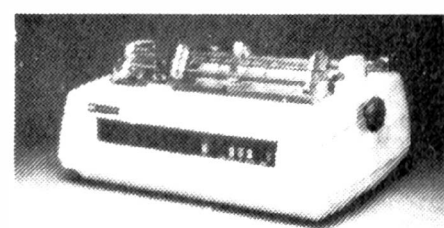
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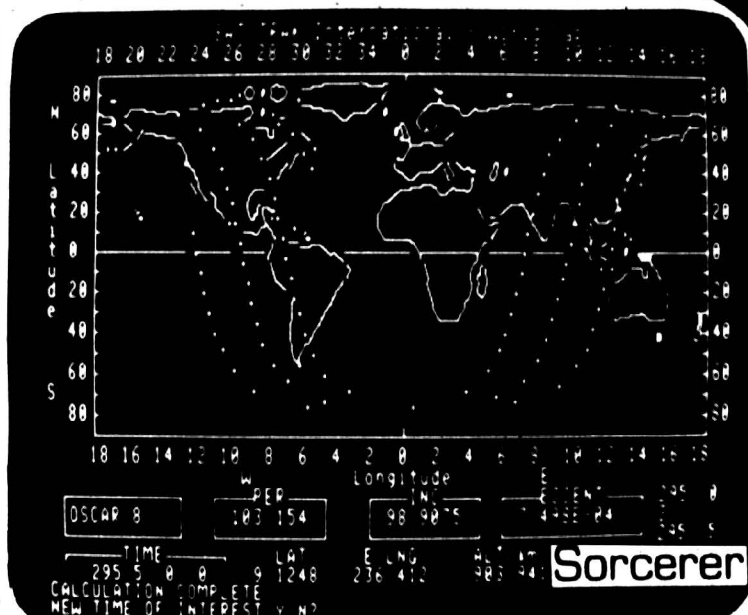
Major components in the system include a standard keyboard with function keys, a 40-character, single-line video display, a cassette recorder, and a communications interface. The Micom 1001 costs \$1295 and is available from Philips Information Systems. Contact Harshe-Rotman & Druck, Inc., Suite 950, 1900 W. Loop S., Houston, TX 77027, (713) 961-1531.

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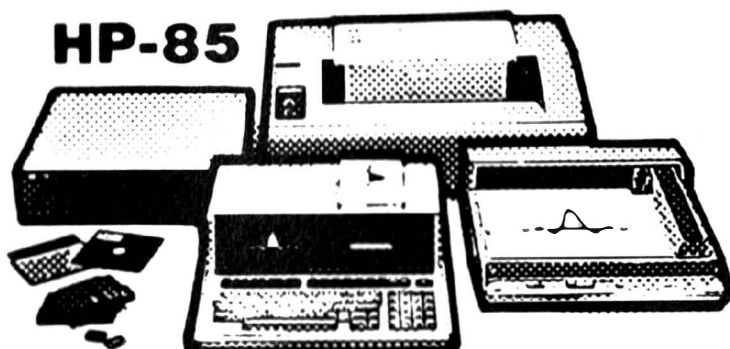
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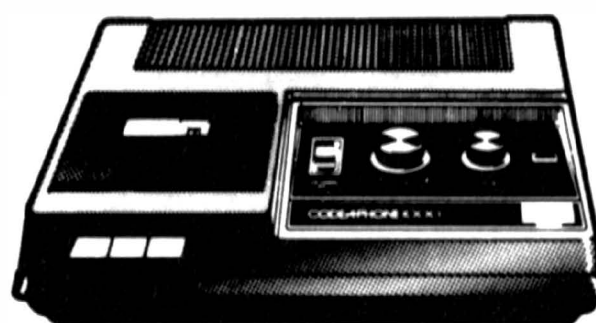
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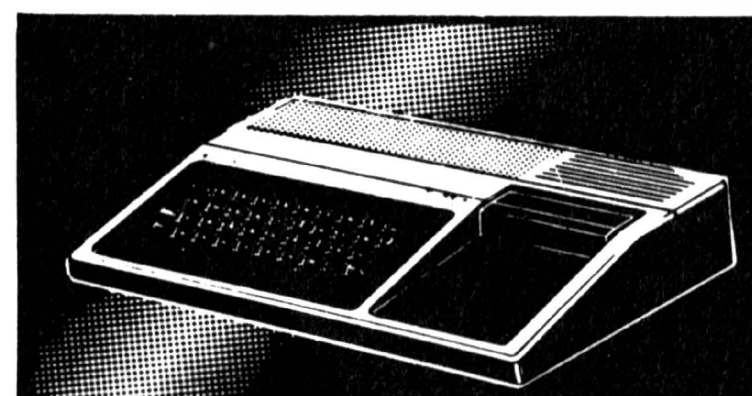
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In Other Words

We chose some of the most common computing terms to include in this glossary.

acoustic coupler: A mechanical device that allows a telephone handset to be connected to a modem. The term is sometimes used to refer to the entire modem.

application program: Software designed for a specific purpose (such as accounts payable or receivable, payroll, inventory, etc.).

artificial intelligence: A specialized field of research in computer science. The term refers to the ability of a computer to perform functions normally carried out by the human brain (such as reasoning and learning).

ASCII: The American Standard Code for Information Interchange. The most generally used format for representing and exchanging textual information among computers. Under the code, each of 96 characters (letters, numbers, and symbols) is given a unique binary number code (1s and 0s).

assembly language: A means of communicating with a computer at a low level. Assembly language lies between high-level languages (such as BASIC and Pascal) and machine language (the 1s and 0s the computer understands at its most basic level). Programmers use assembly language to make efficient use of memory space and to create a program that runs quickly.

backup: An extra copy of software, normally kept on file in case the original program is damaged or lost.

BASIC: Beginner's All-purpose Symbolic Instruction Code. The most used high-level language for small computers.

binary: A numbering system that uses only 1s and 0s. It is an efficient way of storing information in a computer since the hundreds of thou-

sands of microscopic switches in the computer can only be on (1) or off (0).

bit: A binary digit (1 or 0).

bootstrap: A piece of software, usually stored permanently in memory, that activates other pieces of software in order to bring the computer from "off" into readiness for use.

break: An interruption of a transmission. Most small computer keyboards have a Break key that tells the computer to stop what it's doing and wait for further instructions.

byte: A sequence of bits that represents a single character. In most small computers, a byte is eight bits.

CAI: Computer-Aided Instruction. Computers used to teach normally involve a two-way "conversation" between the student and the computer; the computer informs the student of mistakes as he makes them, and is able to respond to the student's demonstrated lack of knowledge.

character: A single letter, number, or other symbol. In a small computer, a character is normally represented by eight bits (one byte).

chip: A generic term for an integrated circuit (IC), a single package holding hundreds or thousands of microscopic electronic components. The term comes from the slices (chips) of silicon of which they are composed.

command: A word or character that causes a computer to do something.

communication: The transmission of data between two points.

compiler: A piece of software that takes a series of commands written in a high-level language and translates them into a lower-level lan-

guage more efficient for the computer to use.

computer program: A series of commands, instructions, or statements put together in a way that tells a computer to do a specific thing or series of things.

CP/M: Control Program for Microprocessors. One of the oldest and most popular operating systems for small computers. An operating system is a group of programs that is often compared to a traffic cop because it actually controls what the computer is doing by acting as an intermediary between the hardware and the software. Any piece of applications software must be written for a specific operating system. CP/M was introduced in 1975 and has become one of the most popular operating systems; an estimated 250,000 small computers use it. Thousands of specialized application programs have been written to be used with CP/M.

CPU: Central processing unit. The heart of a computer that controls all operations of all parts of the computer and does the actual calculations.

CRT: Cathode-ray tube. A TV-like display used with most small computers to show the information the computer has output.

cursor: A position indicator on a CRT. It's normally a flashing or nonflashing square or rectangle.

data: A general term meaning any and all information, facts, numbers, letters, symbols, etc., which can be acted on or produced by a computer.

database: A collection of related data that can be retrieved by a computer (such as a mailing list or list of accounts).

debug: To go through a program to remove mistakes.

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In Other Words

edit: To modify or add data to an existing document or program.

emulation: A process by which some computers can run programs not specifically written for them.

firmware: A term referring to software that has been permanently placed in memory—usually into a ROM (read-only memory).

floppy disk: A disk storage device made from a thin, circular piece of magnetic material. The usual disk sizes used with small computers are 5¼ inch and 8 inch.

flowchart: A common method of graphically planning what a piece of software should do before the actual writing process begins, or for describing what it does after it is written.

garbage: Meaningless information.

graphics: Pictorial information in two dimensions.

hard copy: A printout of information produced by the computer.

hardware: The physical part of the computer (such as the CRT, CPU, memory, etc.), as opposed to software.

input: The transfer of data into the computer.

input/output: Called I/O for short, this is a general term for the equipment (such as modem or printer) connected to a computer and the two-way exchange of information that goes on between the computer and the peripheral.

memory: Circuitry and devices that hold the binary 1s and 0s the computer can access. Examples are main memory (integrated circuits), floppy disks, cassette tape, etc.

microprocessor: The central processing unit of a computer (usually in a single integrated circuit) that holds all the elements for manipulating data and performing arithmetic calculations.

network: An interconnected system of computers and/or terminals. The components do not have to be physically

close to one another and are often connected by telephone lines.

operating system: "Traffic cop" software that oversees the overall operation of a computer system.

Pascal: A high-level programming language named after the seventeenth-century French mathematician Blaise Pascal.

printout: Hard copy produced by a printer.

program: (1) A set of instructions that tells a computer to do something. (2) To prepare the set of instructions.

ROM: Read-only memory. Memory where information is permanently stored and cannot be altered. This form of memory is also random-access.

system: An organized collection of hardware and software that works together.

system software: General-purpose programs that allow programmers to write or modify applications programs. BASIC may be considered part of the system software; so is the computer's operating system.

telecommunication: Transmission of data between a computer and another computer or terminal in a different location. It can be done with phone lines, satellites, radio waves, optical fibers, or other means.

terminal: A piece of equipment with a keyboard for input and an output device such as a CRT or printer. A terminal is used to communicate with the computer.

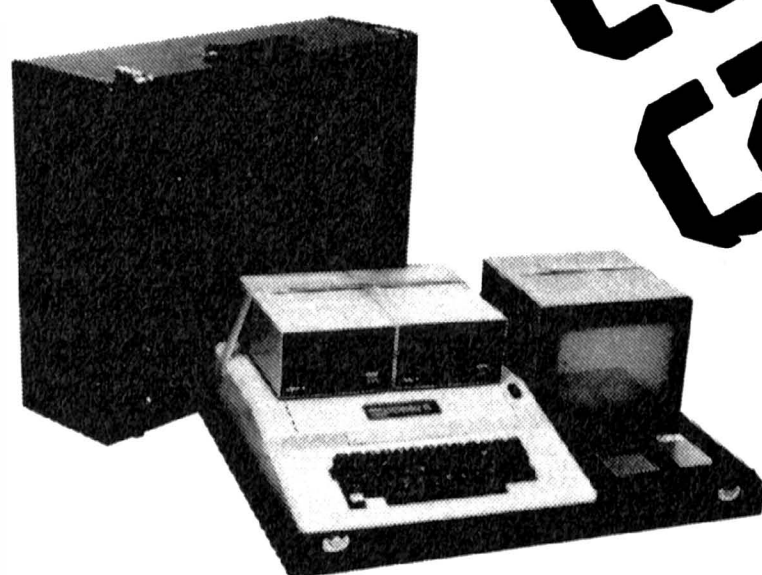
timesharing: A process whereby the facilities of a single (usually large) computer are shared by a number of users. Timesharing requires large amounts of memory and special software to make it appear that each user has the whole computer to himself.

track: A section of a disk or tape.

word processing: The entry, manipulation, editing, and storage of text using a computer. □

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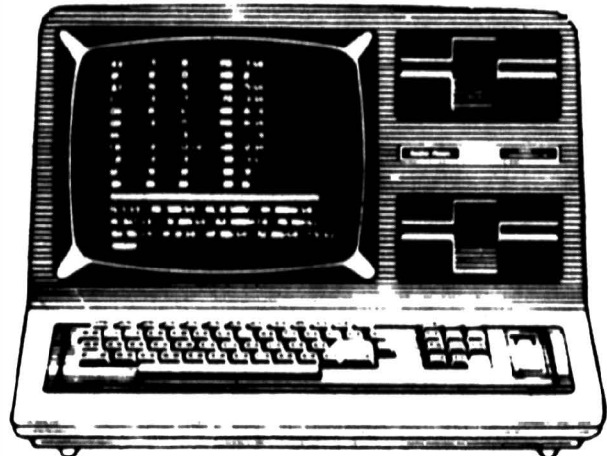
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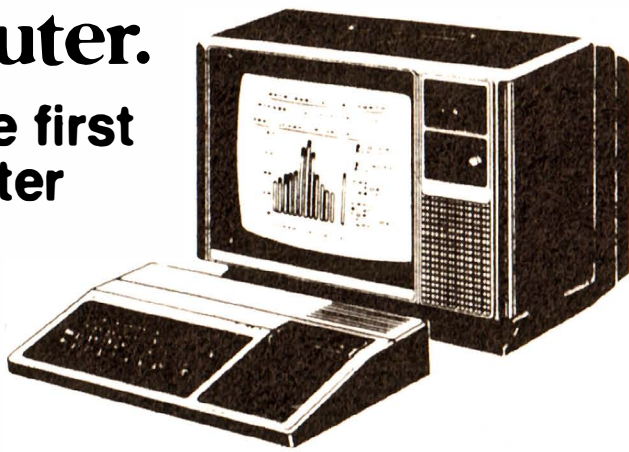
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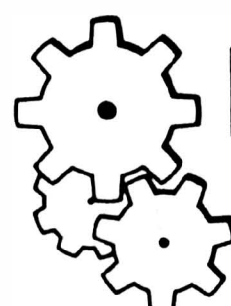
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Coming Up

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A Computer in Every Home—When? — For years industry authorities have been predicting that small computers will soon be as common as telephones in the home. So far the predictions haven't come true. When it will happen and what we can expect are covered in this in-depth report.

The Computerized Car—Fact or Science Fiction? — Detroit is using microprocessors more and more in automobiles, but it's only the beginning. Marc Stern, noted writer about automobiles, looks at what's coming up.

Two Japanese Computers — There's been much talk lately about the "Japanese invasion" of the American small-computer industry. How good are the Japanese products? We'll take a look at two — the NEC PC-8001 and the Hitachi MB-6890.

A Computer from a Kit—The Heathkit H-89 — Should you build a small computer from a kit? *Popular Computing* reporter Rachael Wrege did and tells of her experience.

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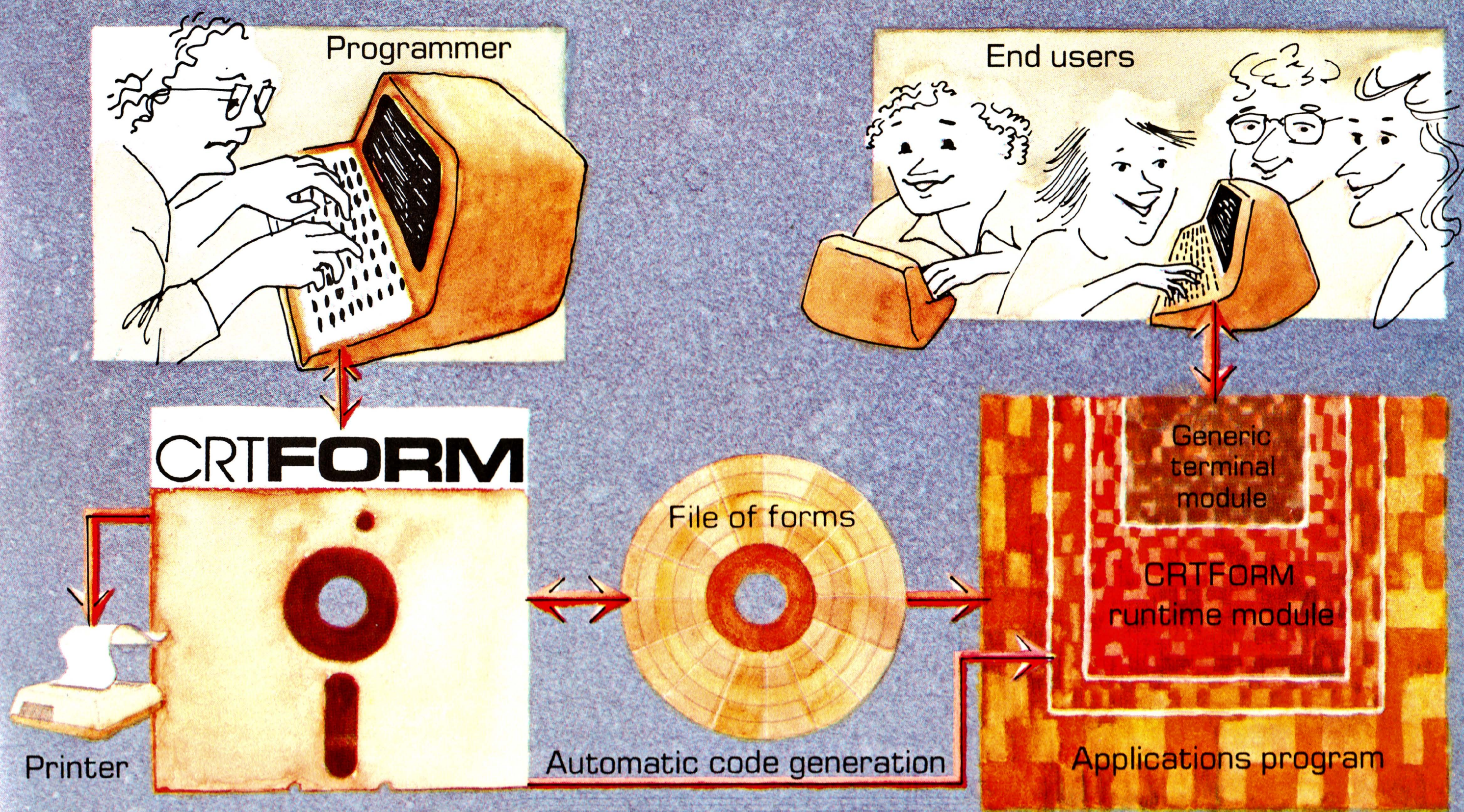
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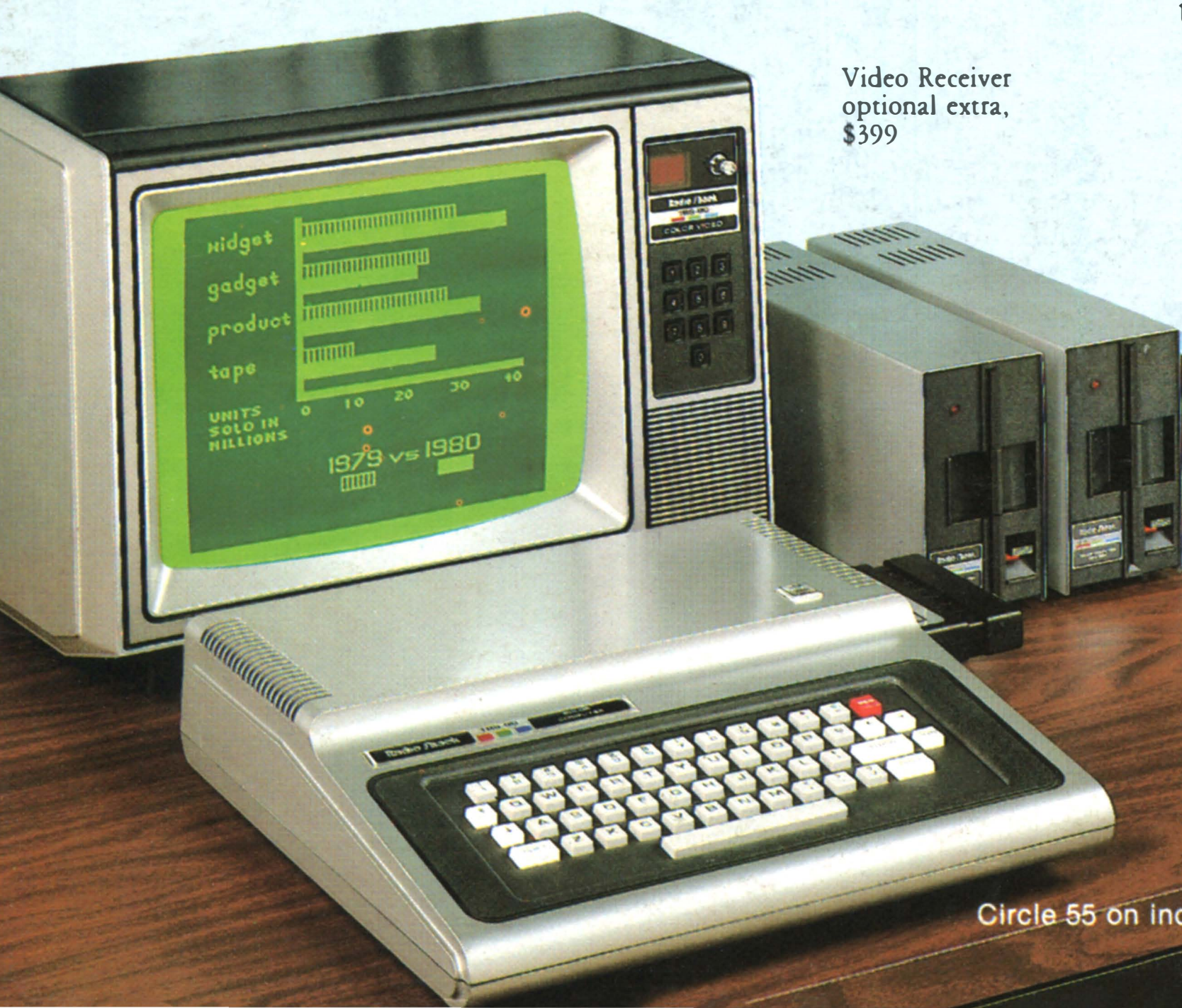
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